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February 1995



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CIRCLE 2 ON INFORMATION CARD

22 3D on the PC.....▶

Although PC-based 3D accelerator boards have been on the market for years, their high cost has made them attractive to only a small number of users. But recent technological advances in both hardware and software are making cost-effective 3D accelerators for the PC a reality. • *By Donna Coco*



▶ 35 Behind the Scenes of *Disclosure*

The use of CG in movies use to be a rarity, but now it seems rare when a movie doesn't employ some form of CG. This month, we look at how IL&M created the virtual-reality environment for Warner Bros.' hot hit *Disclosure*. • *By Barbara Robertson*

42 Rapid Prototyping in Medicine.....▶

From manufacturing medical devices to planning surgery, medical applications of computer-driven rapid prototyping can save time and money while enhancing the delivery of health care. • *By Diana Phillips Mahoney*



50 1994 Editors' Choice Awards.....▶

What were the most innovative and significant products to ship in 1994? CGW editors single out 30 computer-graphics products for special recognition in 10 product categories.



ON THE COVER



The artists at RenderMorphics created this month's cover using their Reality Lab 3D API development tools. The space station, which can rotate in real time, consists of 8000 Gouraud-shaded polygons; it is lit with orange and white light sources against a backdrop of the moon. For more information on 3D on the PC, see page 22.

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Perspectives on 1994

One of the nice things about conducting a year-end product awards contest is that it gives you a chance to look back and gain some perspective. As you sort through the potential award candidates, you get a chance to see the big picture, to assimilate patterns and trends that were hard to spot in the midst of the year's activity.

For example, for all the hype over multimedia and the CD ROM explosion, it seems clearer to me now that some of the most exciting developments this last year took place in the area of image creation. Of the 10 product categories for which we gave out awards, it was the Painting/Illustration/Image Editing category that seemed to have the largest number of strong possible candidates and the most impressive list of winners and honorable mentions. Taken together, the products in this category opened up all kinds of new creative possibilities for computer graphics users, the most noteworthy of which stems from the new ability to paint directly on 3D models.

Animation technology also made some nice advances this year, most notably in the areas of low-cost animation tools and digitizing technology. A whole host of vendors introduced new animation packages this year for both the PC and the Macintosh, giving users access to a wide range of capabilities that once lived only in the realm of high-priced workstations. Meanwhile advances in 3D digitizing tools and motion-capture devices made the Graphics Input category an extremely

exciting one to evaluate, and the new products introduced there should help take some of the pain out of the complex task of modeling and animating.

There were also some exciting advances in head-mounted displays, color hardcopy devices, video editing software, and special effects software. However, advances in CAD/CAM Software were a



little less dramatic, as the year was

characterized less by innovation and more by fairly predictable upgrades to important but well-established products. Certainly the announcement of AutoCAD Designer put a buzz in the air, but the real excitement will take place this year as vendors roll out their competitors to Designer and the race for the mid-range of the CAD/CAM market begins in earnest. Actually, one of the primary contenders in that race, Pro/Junior from Parametric Technology, was formally introduced at press time. It looks impressive, to be sure. Could be a contender, I think, for 1995's product awards. But let's hold off on that conclusion until we see how the rest of the year unfolds.

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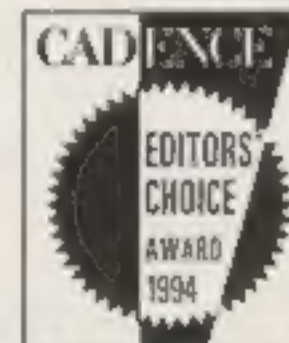
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"CAD data management is much needed, but the current products are far from perfect."

CAD Data Management Solution

In your article "The Challenge of CAD Data Management" (November 1994), the author's conclusions are right on target. CAD data management is much needed, but the current products are far from perfect. That is why Autodesk entered the market in 1994 with its technical-document and workflow-management solution, Autodesk WorkCenter.

Autodesk WorkCenter combines document-management and workflow-automation capabilities that can benefit an entire design team. It provides a secure vault for more than 100 types of documents, including CAD models, spreadsheets, and database files. SmartView Folders let users create their own personal folder organization. Revision numbering, archiving, and backup are performed automatically. An easy-to-learn, customizable Windows interface allows users (not C++ programmers) to tailor the product for any organization. Task-level workflow, such as document routing, electronic approvals, and notifications, are built into the product. Its open architecture allows integration with enterprise-wide data management systems, including many of the products mentioned in your article. And Autodesk WorkCenter is fully integrated with AutoCAD, is affordable (\$695), and can be installed and in full operation quickly and easily.

Andrew Mackles
Autodesk Inc.
Sausalito, CA

A Job Well-Done

What a wonderful job you have done with the redesign.

This magazine is the Bible of most professionals in the field of computer graphics, and it is great to see it keeping up with the times. I must admit, the

traditional cover was such an "old friend" that I will miss it; but the new style has such energy that it demands attention. I also am very happy with the change in content and focus.

Dann M. Stubbs
DSD
Altamonte Springs, FL

For the Record...

I am disappointed Corel Corp. was not approached for comment regarding the December 1994 news piece on the lawsuit Tony Stone Images filed against the winner of the 1994 CorelDRAW World Design Contest. Let me give you some insight about how Corel responded to this situation.

Corel removed the winning entry from its traditional place of honor—the front cover of the ArtShow coffee-table book. The image is not included anywhere in the book, nor is it on the accompanying CD-ROM. All copies of the image that we had duplicated or published on slides for distribution, etc., were thrown away.

Corel is advancing awareness of copyright issues by sponsoring a seminar which addresses the artist's rights and responsibilities, copyright infringement issues, etc. The seminar will be led by informed legal professionals from the US and Canada to provide a broad perspective.

Fiona Rochester
Manager, Media Relations
Corel Corp.
Ottawa, Ontario, Canada

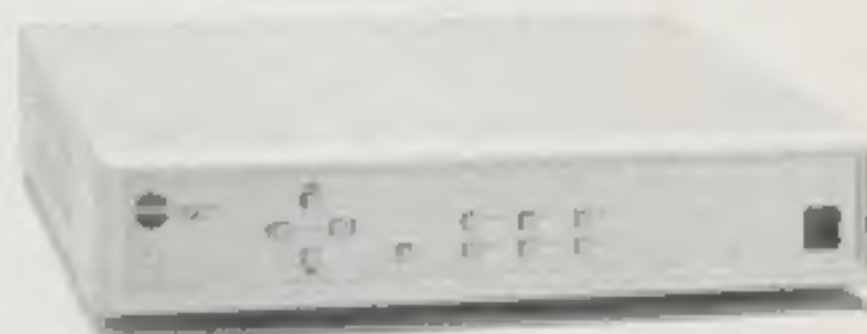
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"Incredible!"




"aaaaaaahhhhhh!"



"Yes! Yes! Yes!"

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
Then you can output and distribute your work in realtime in any format you want. That includes videotape, CD-ROM, laser disc, display monitor or live to air.

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Media 100 version 2.0 doubles our industry-leading nonlinear image quality standard. New compression ratios are as low as 4:1. New Media 100 quality settings are as high as 150 kb/frame. You'll have to compare the picture quality to Betacam SP tape in an online suite to see just how good it is. And remember, this is all nonlinear editing. We're talking about realtime.

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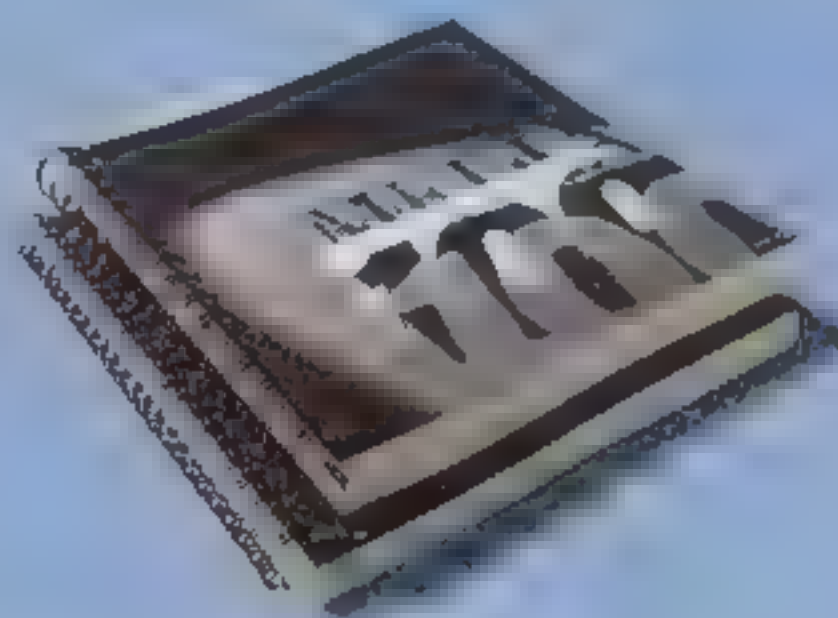
Media 100 version 2.0, from Data Translation, makes you and everything you do look better. And at \$8,995, you can afford to do it.

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"Oooooooooooooooooohhhhhhhhh!"



"I gotta get one of these!"

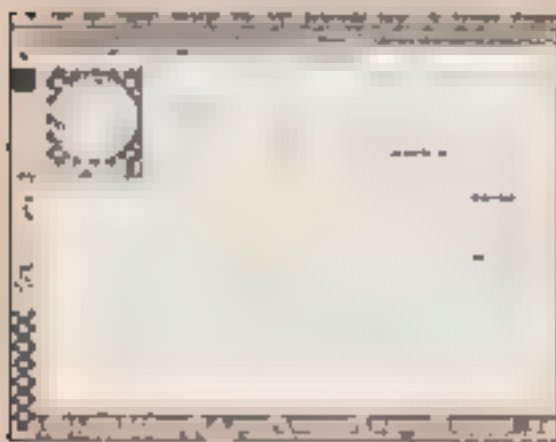


"Call me."

Ashlar Claims Patent Infringement

Ashlar Inc. (Sunnyvale, CA) has filed patent infringement complaints against Structural Dynamics Research Corp (SDRC, Milford, OH) and Diehl Graphsoft (Columbia, MD), claiming the companies have unfairly copied Ashlar's patented "Smart Cursors" user interface technology into their respective products. The complaint requests triple damages for the "deliberate nature" of the alleged infringement.

According to Ashlar, its Smart Cursor technology places on the cursor a "hot spot" which identifies the starting point of an operation (such as the center of a



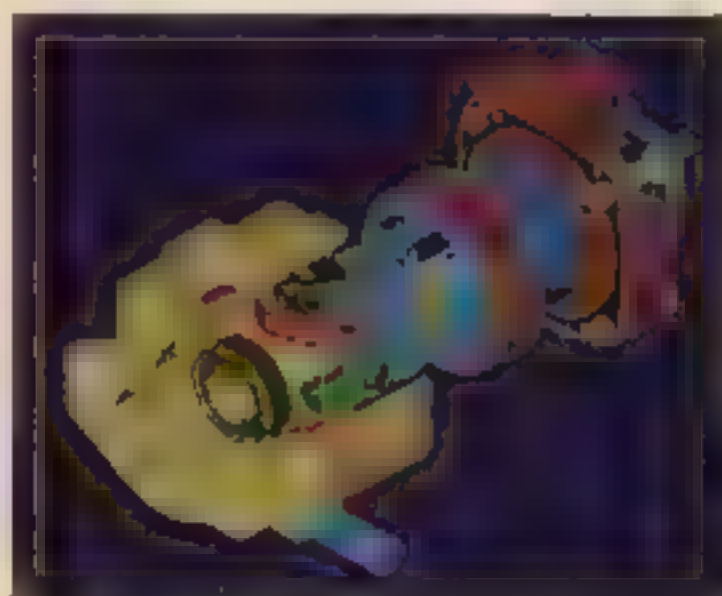
circle). After the user clicks a point, the hot spot moves to the next definition point on the object being created. This graphical feedback is combined with a Message Line providing more detail on the use of each tool. All drawing and editing tools in Ashlar's Vellum 3D design and drafting software feature Smart Cursors. According to Ashlar president and CEO Jack Hendren, Auto-trol, Clans Corp., and Toyota-Caelum Ltd have legally licensed the use of the technology.

Apple Intros CD-ROM Platform

Apple Computer (Cupertino, CA) has announced a new platform for multimedia players that it says will provide consumers with high-performance, affordable CD-

Matra Offers Solid Designs on a PC

Mechanical designers and drafters who want to migrate from their 2D or 3D wireframe-based CAD system to a full-function solid modeling system, but who don't want to



leave their PCs, can do so with the newest version of Matra Datavision's Prelude Design 3D solid modeling and drafting software.

Prelude on Windows NT, which runs on 486, Pentium, and Digital Alpha AXP machines, comprises three modules. Prelude/Solids offers feature-based solid modeling tools including Matra's Adaptive Modeling technology, visualization capabilities; and dimension-driven editing. Prelude/Drafting—an associative drafting system for annotating and dimensioning Prelude/Solids models—features context-sensitive dimensioning, detailing, and crosshatching. And Prelude/Interfaces facilitates data exchange in IGES, CADL, DXF, AMF, and SLA formats and lets users recover data from existing files as well as communicate with third-party CAD systems. The price for the bundled package is \$5500. (Tewksbury, MA 508-640-0940)

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ROM-based systems for education and entertainment. Called Pippin, the platform is derived from the Mac OS and the PowerPC 603 microprocessor; Apple plans to openly license Pippin to various vendors from different industries.

According to Apple, developers will need to only slightly modify current Mac multimedia software programs to make them compatible with Pippin-based systems. Also, CD-ROM titles developed for Pippin can be played without modification on a Mac.

Japan's Bandai Co. Ltd., one of the largest family-entertainment companies in the world, will be the first to license Pippin; Bandai plans to introduce its multimedia player in late 1995.

Update on FPG/Newsday Lawsuit

An out-of-court settlement has been reached between stock photography firm FPG International (New York City) and Newsday, the nation's

Snapshots in a Snap From Play Inc.

With Snappy Video Snapshot, a new pocket-size video grabber from Play Inc., users can transform images from camcorders, VCRs, and TV screens into high-resolution still images. The new device snaps onto the parallel port of any PC or laptop and grabs 16.8-million-color stills at resolutions of up to 1500x1125. When you see a picture you want, click "Snap," and in 1/60th of a second Snappy freezes the video. Then click "Save" to save the image for use in your application. Snappy saves images in BMP, PCX, TIFF, GIF, and compressed JPEG file format and lets users bring images into

Media 100 Enhanced, Price Slashed

A host of new features—as well as a 25% reduction in price from \$11,995 to \$8,995—highlight version 2.0 of Data Translation's Media 100 digital-video system for creating broadcast-quality video from a Mac.

Heading Version 2.0's list of features are a new trim mode and dual subsampler, auto (batch) digitizing, field-interpolated MotionFX, and improved on-line finished video quality. In addition, a new QuickTime Codec lets users instantly click and drag transfers of Media 100 files and clips to QuickTime applications, and it maintains a high quality level by eliminating video degradation typical with repeated compression and decompression.

Version 2.0 also offers two new option packages. The Power Option (\$3995) includes All-On-One Mastering, which provides high-capacity

second-largest four-color daily newspaper after *USA Today*.

In an action first brought last February, FPG accused Newsday of digitally scanning a color photo from one of its printed photo catalogs, then electronically altering the image as part of a computer-generated montage which Newsday allegedly used to illustrate a page-one cover story on virtual reality. The credit line identifying the image reportedly made no reference to FPG or to the photographer of the image and instead credited the visual as a

"Newsday Computer Illustration" created by one of the newspaper's graphic artists.

According to FPG, the negotiated settlement includes a retroactive licensing payment of \$20,000 (10 times the initial licensing fees) for the photo under dispute. FPG was also granted a significant portion of attorneys' fees. In addition, FPG is free to discuss the case (a settlement attempt last summer broke down in part when Newsday tried to impose a gag order on FPG).



most PC-based graphics programs without saving and reloading.

Included in Snappy's \$199.95 price tag is a copy of Fauve Matisse SE, a version of Matisse developed specifically for Snappy. Besides offering a specially developed colorize feature, the Snappy Edition of Matisse also enables users to composite themselves into any picture captured from a camera, tape, laserdisc, or live TV. Snappy also ships with a copy of Gryphon Software's Morph 2.5 morphing program, so users can morph images of themselves as well as of celebrities. (Rancho Cordova, CA; 916-851-0800)

CIRCLE 64

draft-mode editing and high-quality on-line mastering capabilities as well as more FastFX (accelerated rendering of special effects), logging on the fly with the Powerlog format, and auto (batch) digitizing. The \$3995 HDR option, meanwhile, provides high image quality and up to 150KB NTSC and 180KB PAL rates. (Marlboro MA, 508-460-1600)

CIRCLE 65

Alias Gives StudioPaint a Facelift

Now Alias Research's StudioPaint program runs on the full line of Silicon Graphics systems, including the entry level Indy. In addition, the price of the program has been slashed by more than 70%. Prices for StudioPaint Version 2.0 now start at \$14995 for SGI's Indy and Indigo² systems and \$24995 for VGX, VGX1, VTX, RealityEngine, and BE² systems.

Besides the decrease in price, StudioPaint version 2.0 offers enhanced digital facelift capabilities, including a Magic Wand, which lets users select

areas for masking based on the color similarities of adjacent pixels; an HSV Tool, for shifting the ranges of hue

saturation and value of selected areas of an image; Effects Brushes; Flood Fill, for automatically filling an area with a given color; a Brush Profile Editor, for adjusting brush shape and how the brush is applied to the canvas; and a Polyline Brush, for



Image created by Russell Paul using Alias StudioPaint

pixelization problems that are prevalent with other projection systems available today," claims ARC president David T. Bennett. "Combined with ARC's software, hardware for real-time interaction, optics, masks, and other technologies, ARC can obtain a film-like quality when interfaced to standard workstation output and then wrap the animation around you and immerse you in worlds you could only imagine until now."

ARC's first product is a 3D, full-color raster-based,

immersible, large-scale digital theater that can be either interactive or noninteractive. The initial systems are enclosed in a 16-foot dome or sphere that can be either portable (inflatable or interlocking) or permanent. Portable units are designed to be set up in less than four hours by two people with no heavy equipment. Larger units (in the range of 24 feet and up) are in the early developmental stage.

The initial product lines include several sizes and levels of resolution as well as

varying degrees of interactivity. According to ARC, strategic partnerships with virtual-reality companies that provide supporting technologies are underway, as are many OEM and licensing arrangements. Several early projects are being planned during the first and second quarters of 1995, and product is expected to be available in the third quarter of 1995 on a limited basis.

Corel Corp. Announces Software Licenses

In preparation for the release later this year of new Windows 95-based applications, Corel Corp. (Ottawa, Ontario, Canada) has announced it has licensed a number of software programs on a perpetual nonexclusive basis. Among the programs Corel has licensed are DesignCAD 3D for Windows (from American Small Business Computers, Pryor, OK), Ray Dream Designer for Windows and addDepth for Windows (from Ray Dream Inc.; Mountain View, CA), and LogoMotion for the Macintosh (from Specular International; Amherst, MA).

According to Corel, it plans to port the above-mentioned technologies to Windows 95 over the next four to six months for integration into new-product releases targeted for the second and third quarters of this year.

Microsoft Supports Audio-CD Format

Microsoft (Redmond, WA) has announced plans to support a new audio-CD format that will reportedly let users not only

New Firm Enters VR Market

The burgeoning virtual-reality field has a new player—Alternate Realities Corp. (ARC, Research Triangle Park, NC)—which has developed a virtual environment that it says immerses participants in a 3D full-color interactive world complete with 360-degree projection and a 180-degree field of view. According to ARC, the new system is designed for use in a range of



applications, including scientific visualization, education, and entertainment.

"We have a projection engine that works well with our other technologies to produce a crystal-clear image directly from a workstation, PC, or standard video input onto a very large-scale curved screen, without the annoying

play music, but also view video clips, photos, animation, and text on audio CDs created under Windows 95 and played on Windows 95-compatible PCs (the discs can also be played as audio CDs on standard CD players). As part of its support program, Microsoft will provide the music industry with tools designed to facilitate the creation of the new discs.

Microsoft also announced plans to support an effort by Sony and Philips to develop a uniform definition of a multisession-type CD format, called "stamped multisession technology." Microsoft says it is working closely with the two companies to ensure that the new format will be supported by Windows 95's multimedia capabilities.

Time Warner to Include SGI Technologies in Full Service Network

Silicon Graphics Inc. (Mountain View, CA) has unveiled an array of interactive technologies as part of the debut of Time Warner Cable's Full Service Network (FSN, Orlando, FL). According to SGI and Time Warner, the FSN delivers the most advanced solution ever deployed for



interactive television services and is the first ever to deliver fully functional, truly interactive applications to cable television subscribers.

The SGI-developed interactive technologies being incorporated into the FSN include FSN system software and user interface applications as well as video-on-demand

connecting a series of points as the outline of an object. (Toronto; 416-362-9181)

CIRCLE 66

Sun Enters "hyperSPARC"

Floating-point performance and cache memory architecture highlight the list of features Sun Microsystems has incorporated into its new SPARCstation 20 Model HS11 workstation. This newest member of the SPARCstation 20 family, targeted at compute-intensive technical applications including simulation, modeling, and analysis, uses a 100MHz hyperSPARC processor from Ross Technology Inc. and is supported by the Solaris 2.4 and Solaris 1.1.2 software environments. The "pizza box" workstation also offers up to 512MB of main memory, up to 2GB of internal mass storage, and four SBus slots and includes a CD-ROM drive, a 3.5-inch floppy drive, and high-quality audio capabilities.

A base configuration containing 32MB of memory, 1GB of mass storage, and a 17-inch TurboGX color monitor is available for \$18,695. (Mountain View, CA; 800-821-4643)

CIRCLE 67

Hash Rehashes Animation

Designed for classic character animation applications, Hash Inc.'s Animation (Playmation) Version 2 spline-based modeling and animation program combines the 3D character animation tools found in Hash's original Playmation system with the company's previously optional Render24 module to offer

and three interactive game applications. SGI also supplied eight of its Challenge symmetric multiprocessing media servers for use in the network operating center as well as MIPS RISC-based digital media technology for Scientific-Atlanta's prototype FSN home communications terminal, or set-top device.

According to SGI, much of the fundamental technology used to create the Full Service Network will be instrumental in developing SGI's solutions for other interactive projects, including a test of interactive

multimedia services in Japan with Nippon Telegraph & Telephone. In addition, the underlying system software architecture will be used to commercially deploy large-scale, fully integrated interactive video server solutions by Interactive Digital Solutions, a joint venture of SGI and AT&T that develops middleware and application development frameworks and tightly integrates them with hardware from open systems suppliers to provide solutions for interactive services

more than 100 new features and interface shortcuts. Particularly noteworthy, says Hash, is the ability of animators to now build libraries of actions and characters that can be reused over and over. Animation (Playmation) Version 2 is available for Windows and Mac systems for \$349.

Hash also offers Animation Master, which combines Playmation's 3D character animation tools with the previously optional Decal module and adds new features such as inverse kinematics, a materials editor with channel

control for animating procedural textures, and new output types in the renderer including motion blur, field rendering, and shadows and buffers. Animation Master is available in Windows, Mac, and Power Mac versions for \$699 and in an SGI version for \$999. Hash is also developing versions for PowerPC and Windows NT systems. (Vancouver, WA; 206-750-0042)

CIRCLE 68

Xitron Improves PC-Based CAD

In the latest release of its XCAD 2D/3D CAD software, Xitron Software Corp. has added DWG/DXF file compatibility, a macro facility so users can automate frequently used commands, support for unlimited layers, a customizable toolbar, a 2D/3D symbols library, and command emulators that accept AutoCAD, Generic CADD, and Microstation keyboard commands. In

BBS Offers Vendor-Specific Texture Maps

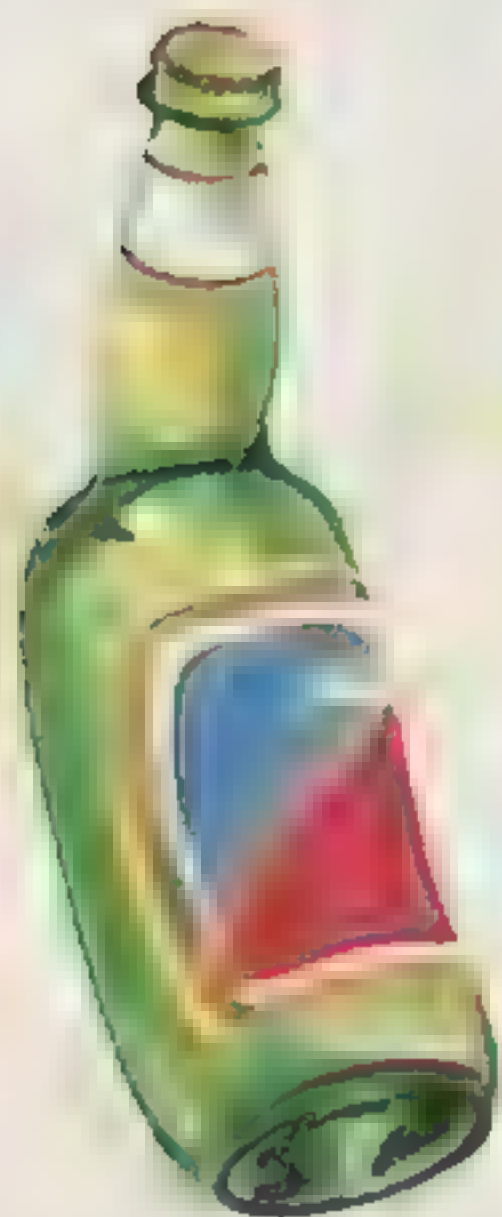
3D computer rendering and animation firm Pixel Technology Inc. (Albany, NY) has unveiled M²APAS (Materials, Meshes, and Products and Specifications), a nationwide bulletin board service offering designers a range of texture maps of everything from wall coverings to carpets, vinyl floors, fabrics, and laminates.

Users log on to the bulletin board and select a manufacturer, then download the products they're interested in for use in their computer renderings. Included in the downloaded file are product specifications and sizing information to help fit the material into the drawing. Available in TIFF and TGA file formats, M²APAS supports a range of rendering software, including 3D Studio, Topas Autovision, and AccuRender.





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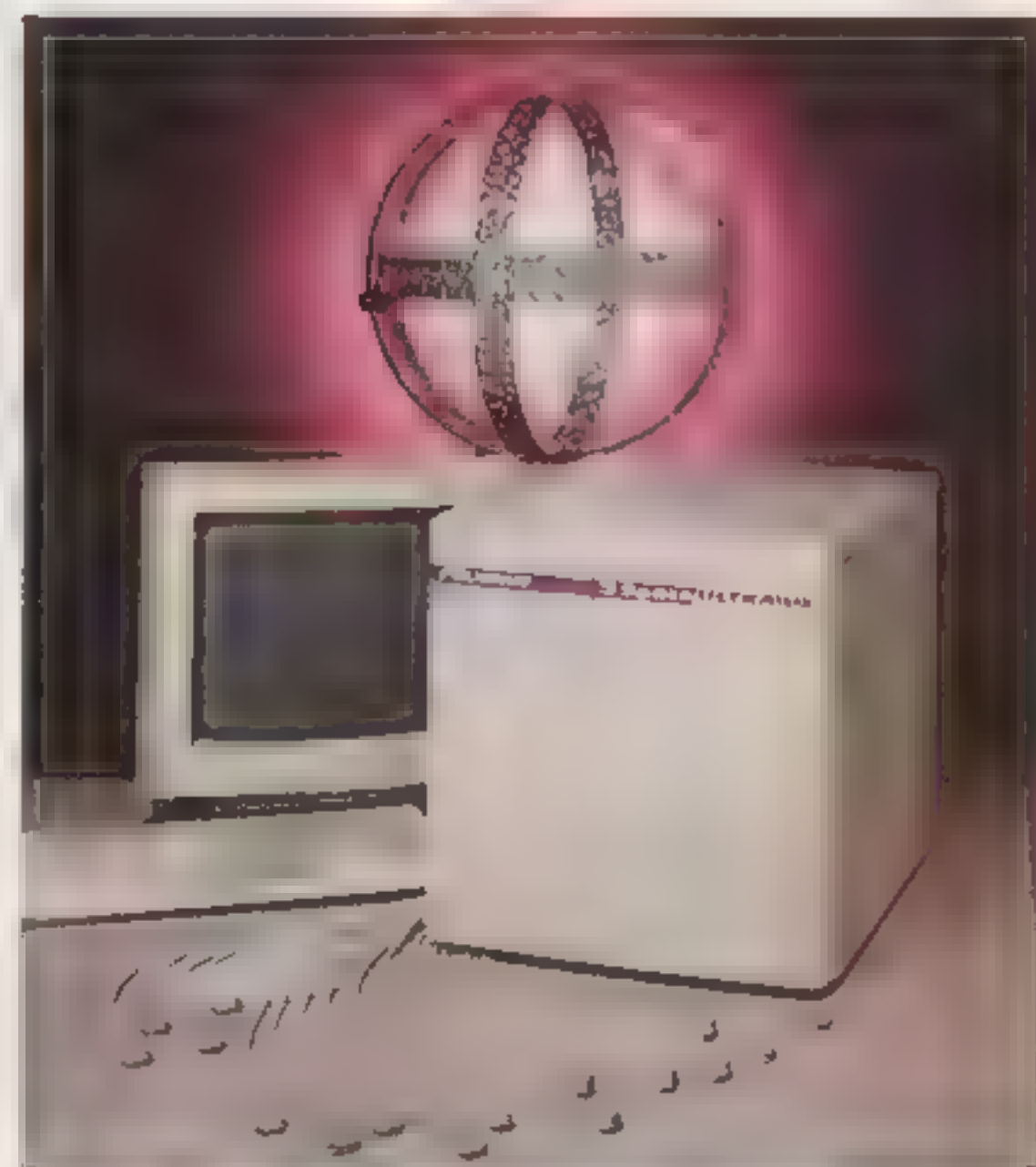
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CIRCLE 7 ON INFORMATION CARD

ALSO • NOTE

Matra Datavision (Tewksbury, MA), a supplier of customer-oriented CAD/CAM/CAE solutions, has acquired **Cisigraph** (Paris), also a leader in the CAD/CAM/CAE market.

SDRC (Milford, OH) has announced that **IBM** (White Plains, NY) will no longer market and support SDRC software. SDRC will continue to offer its software on the IBM RS 6000 platform worldwide.

According to **The 3DO Company** (Brewster City, CA), as of year end, sales of its Interactive Multiplayer system had approached a worldwide installed base of 500,000 units.

News reported by *Audrey V. Doyle*, managing editor.

Alpha Systems Lab Beefs up Video Capture

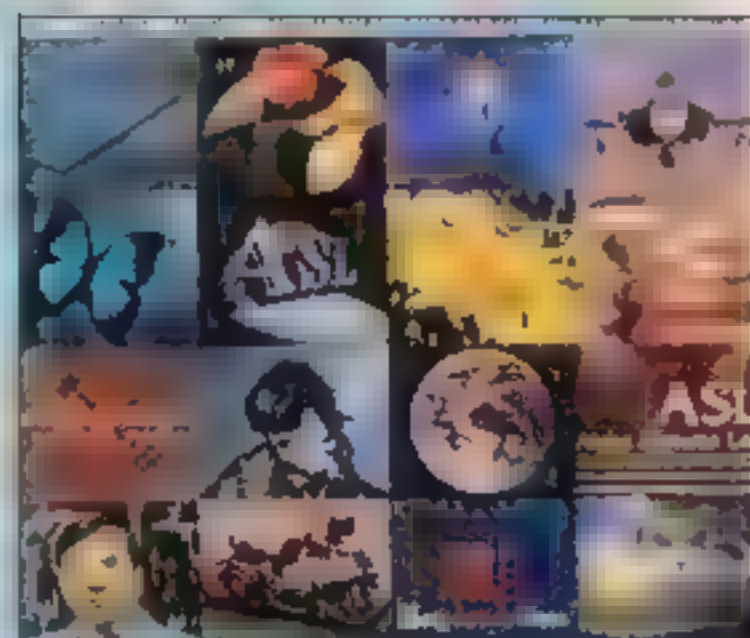
Release 1.06 of Alpha Systems Lab's MegaMotion PC-based video-capture board not only provides a 20fps frame rate for video played back at 640x480 resolution, it also expands the number of multiple overlay images available for video playback from four to 16.

Other new features in the \$995 board include a 30% increase in video decoding speed, the ability to perform with just one interrupt, and compatibility with Video for Windows 1.1, which ensures synchronized audio and video for multimedia productions of up to three hours. In addition, an improved frame-transfer rate reportedly enhances the board's performance when operating under Windows, and an automatic selection feature enables the

MegaMotion board to recognize whether the system has 1MB or 2MB of memory and configure accordingly.

Based on the Motion-JPEG format, MegaMotion supports real-time, full-motion video compression and decompression, offers full image-capture capability and 24-bit VGA performance, and is reportedly the first desktop video board to enable playback of more than two overlay images on a desktop PC simultaneously (Irvine, CA; 714-622-0688).

CIRCLE 69



addition, this \$495 package for Windows Windows NT, and Digital's Alpha AXP systems also features XDS (XCAD's Software

Development Kit), a C language interface that lets users develop third-party software as well as provides a method for user programs to interface with XCAD. (Cincinnati, 513-762-7638).

CIRCLE 70

Multiformat CD Player

For many consumers, the recent deluge of CD-based products raises questions as to which CD player represents the appropriate investment. Multiwave Innovations is attempting to address this issue with MovieWave Station—a CD player that accommodates all major CD formats, including video CD, CD-i full-motion video, Kodak Photo CD, audio CD, karaoke CD, and CD+G.

As a video CD player, for example, MovieWave Station provides full-motion MPEG ISO11172 video decompression and MPEG ISO11172 layer II audio decompression and supports playback of video CD books and Philips CD-i Digital-Video-format discs. When playing Kodak Photo CDs, the device lets users selectively or sequentially view images and offers remotely controlled selection, rotation, and zoom functions. Meanwhile, to accommodate video playback, the player provides composite video output (NTSC and PAL). In addition, it incorporates a user-controlled 3D surround-sound circuit that generates a continuous 270-degree soundfield from mono and stereo program material.

MovieWave Station is scheduled for availability Q1 1995 for a suggested retail price of \$399 (Campbell, CA; 408-379-2900).

CIRCLE 71

Products written by contributing editor *Laureen Belleville*

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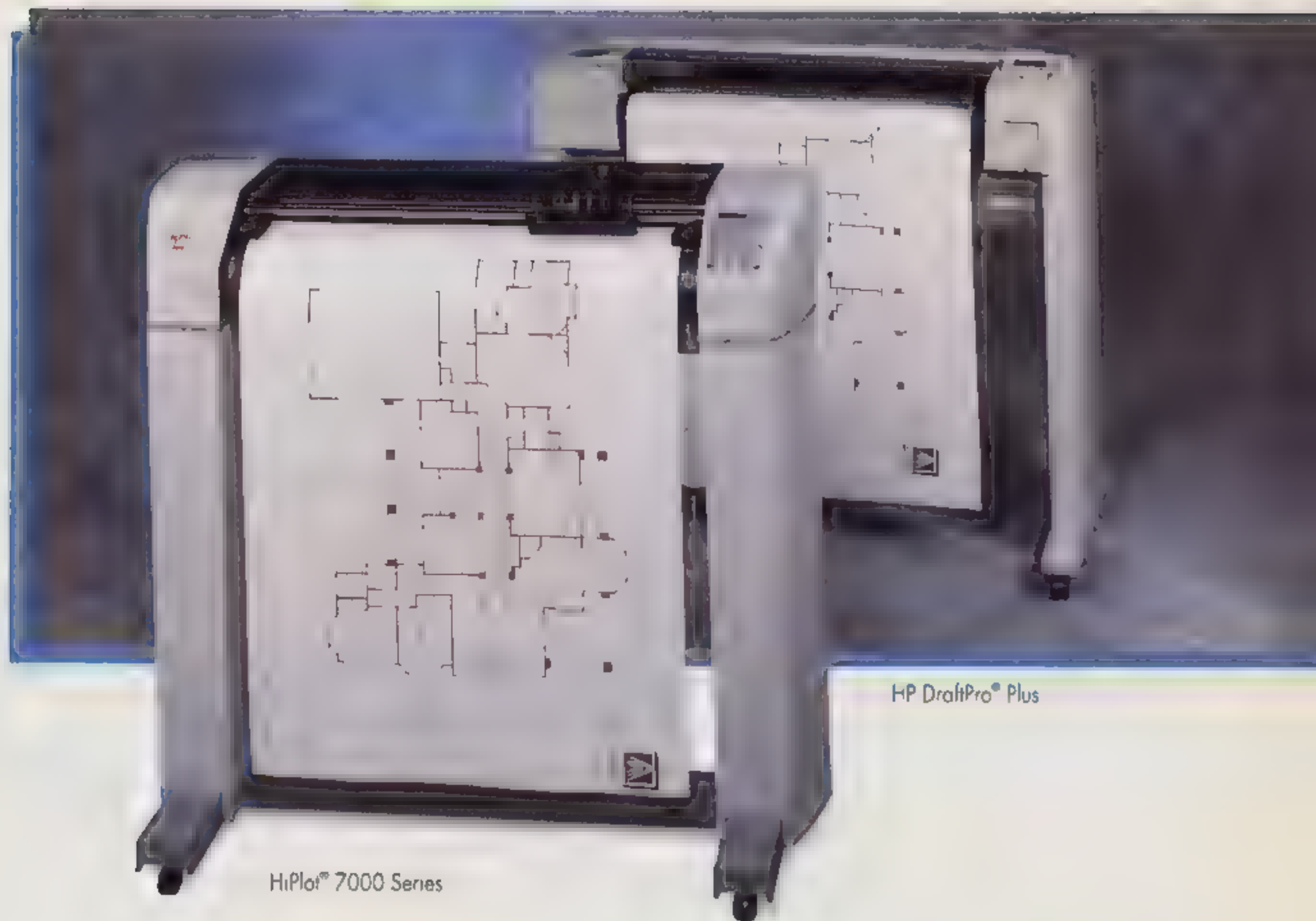
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QUICK LOOK

UNDER A KILLING MOON

Intriguing—that's how I'd describe *Under a Killing Moon*. Not being a huge fan of puzzle solving and suspicious of CDs hyped as virtual worlds (too many slow scrolling and preset plots for me),



I wasn't too excited about doing this review. But I was wrong. First, a quick overview of the plot. *Moon* is a four-CD mystery/movie, set in the year 2042, in which you play Tex Murphy, a 1930s throwback PI. You solve cases by roaming the streets, looking for clues and talking to friends and acquaintances to gather information. What I liked best

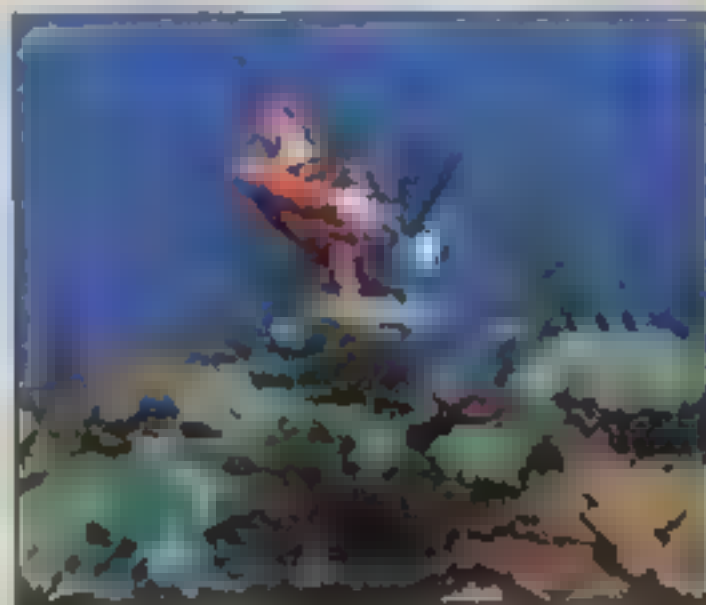
is that you really can just roam around. The movement is seamless, and you can go anywhere you want—albeit you'll need at least a '486 with 16MB of RAM to achieve this feat. Developer Access used video nicely, too. Characters were composited into beautifully rendered backgrounds created using custom tools and 3D Studio, adding to the virtual-world feel of this CD. And there are enough simple puzzles to get someone like me started, yet enough depth to keep the more hardcore puzzle solvers intrigued as well. Actually, I'll probably take another crack or two—or three—at this one. (PC DOS. Developer/publisher: Access Software, 800-800-4880.)—Donna Coco

DONKEY KONG COUNTRY

Before you sit down with this game, make sure you have an ample supply of coffee, soda, pizza, and chips, because you're not going anywhere soon. Using Nintendo's proprietary videogame technology called Advanced Computer Modeling, developer Rare Ltd. created the next level of video game—and it fits on a cartridge (32M of data). Rare also used SGI

workstations and AI as' PowerAnimator software for development. The result: a stunning, 3D environment unlike anything I've seen before. No flat, 2D sprites with scrolling backgrounds here. In

Donkey Kong Country, everything has depth. When it starts to snow, it seems like it's snowing all around you. Or day may slowly fade into night. Thankfully, game control is easy, because you've



got more than 100 incredibly detailed areas to explore (plus a surprise ending). Rare included a save-game feature, too, which is exceptionally important—unless you really don't plan on going out for a few months. *Donkey Kong Country* is not destined to be a classic—it already is. (SuperNintendo. Developer: Rare Ltd. Publisher: Nintendo, 206-882-2040.)—David Singer

1 Virtual Adventure

Multiperson experience pits six-player pods against each other in a virtual world in which you search the ocean for Loch Ness monster eggs. (Iwerks)

SIX-HOT VR RIDES

2 X-21 Hornet

Fly the X-21 Hornet fighter plane against competitors; whoever shoots the most targets wins. (Mage Edge)

3 Zone Hunter

A new, lighter headset with better resolution premieres with this game, in which you battle alien creatures and killer robots. (Virtuality)

4 Aladdin

Hand-painted textures on all computer models and animated inhabitants developed using motion capture combine to create an experience like no other. (Disney)

5 CueView

You are the cue ball in this pool simulation, realistic motion dynamics of balls cueing off each other highlight this experience. (Greystone)

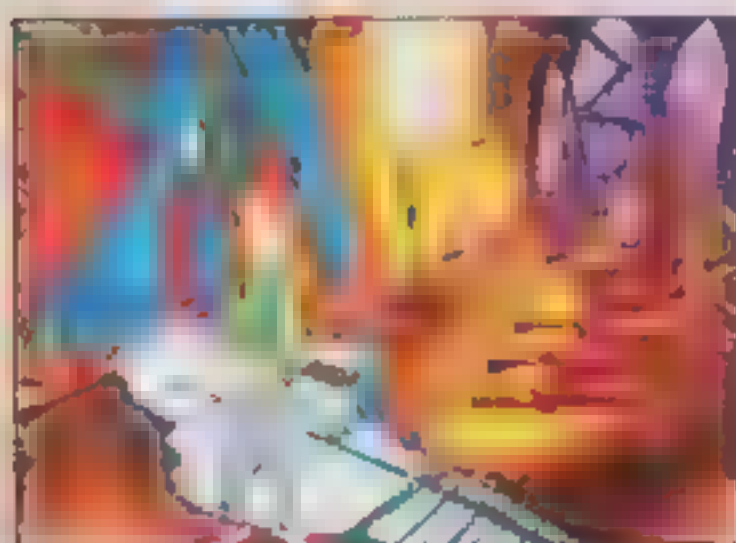
6 Red Planet

You're a miner on Mars; fly your craft through the shafts and corridors faster than anyone else—without losing your life—and you win. (Virtual Worlds Entertainment)

Compiled by Douglas King, C&W contributing editor and high-tech entertainment consultant.

CDs of Note

Who'd have thought "computer repairman" could be such a dangerous job? The creative talent at ReadySoft. deve-



oper of *BrainDead 13*, that's who. You play Lance, the computer repairman, who, after answering a late-night service call finds himself facing the evil Doctor Neuro Neurosis—actually, a disembodied brain displayed on a

huge monitor. Seems this Doctor plans to take over the world computer network, and only Lance can stop him. Expected April, 1995.

A smoky club is the setting for *Comedians*, one of the first CDs from Magnet Interactive Studios. Based on photojournalist Arthur Grace's book, *Comedians* lets you peer into the



world of such top stand-ups as Robin Williams, Whoopi Goldberg, George Carlin, and Steven Wright. Wander backstage into their dressing rooms and discover photos, audio and text interviews, or video performances. You're navigating through animated 3D environments, so you can roam around, almost as if you were really in the club. Expected Q1 1995.

One of the best games yet for the 3DO player, *Demolition Man* (based on the Stallone/Snipes movie) comes from Virgin Interactive. This is definitely an arcade-style game—which is why I like it so much. In *Demo Man*, you get

to shoot, fight, and race, all in one game. Extra video footage was shot during the filming of *Demo Man* just for this game, and the video fits perfectly with the dark, burning sets (done with 2D and 3D animation) of Los Angeles in 1996. Available now.

In *Rise of the Robots* (from Time Warner Interactive), the robots actually learn while fighting so as to anticipate their opponent's strategy and adapt their defenses accordingly. That's because UK-based developer Mirage used artificial-intelligence tables to develop the robots. One player controls the Cyborg (the main fighter); if two

QUEST FOR FAME: FEATURING AEROSMITH

Quest for Fame has to rate as one of the most innovative CDs that I've played. It comes with a full-size pseudo guitar that you



challenge. The CD is nicely constructed, featuring excellent use of videotaped characters who react to your performances, these are composited with beautiful, hand-crafted animations and backgrounds. (Windows. Developer/producer: Ahead Inc., 617-271-0900)—
Stephen Porter

CAROLINES PRESENTS JOHNNY COCKTAILS

Here's a CD for the "Seinfeld" wannabe. Build your own stand-up routines with *Johnny Cocktails*. Simply select from the hundreds of jokes and transitions in the Joke Category list and "insert" them into your act. Then click on the Stage sign and watch clay-animated, Vegas-style comedian Johnny Cocktails—your alter ego—perform your act at Carolines, one of New York's hottest comedy clubs. You can piece together your routine any way you like, choosing from jokes about such subjects as mothers-in-law and politics. While most of the jokes are pretty funny (all were prepared by two



ex-National Lampoon editors and are delivered by real-life comedian Bobby S. ayton), I found the package's claim that "the clay animation is so real, you can smell the beer-stained breath of the audience" somewhat of a stretch. I also question this CD's long-term pay value. Yes, Johnny can deliver the jokes in any order you want. But let's face it: The jokes aren't as funny the second time around. (Windows. Developer/publisher: Great Bear Technology, 510-631-1600)—
Audrey Doyle

OCEAN LIFE VOLUME IV: THE GREAT BARRIER REEF

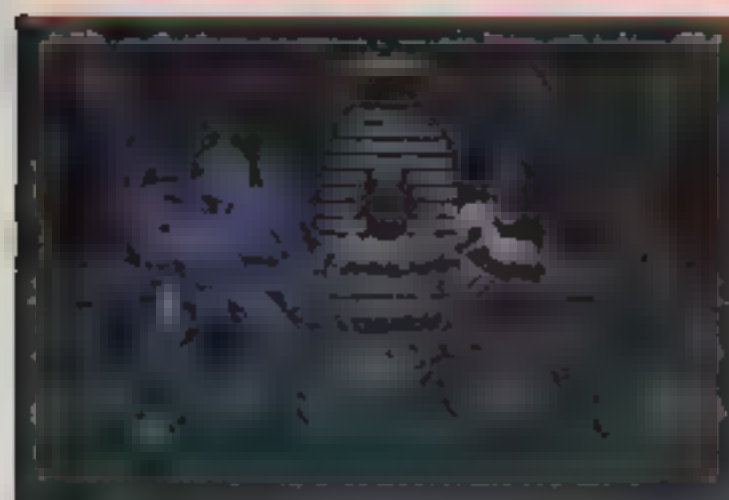
Fish, fish, everywhere, and not a one to eat. This latest addition to Sumeria's OceanLife series of CDs on marine life tells you everything you could possibly want to know about fish in the Great Barrier Reef—except, perhaps, how to cook them. A budding ichthyologist I'm

not, yet even I was impressed by the quality and content of this two-CD set which includes three hours of narrated underwater video, music, and photography on 250 species from more than 40 families of reef fish. The digital



sound is excellent and the video runs smoothly too. Plus, the CD is easy to navigate: Access any option via icon, name, or keyword. Click on a species and you get an alphabetical listing of fish within that species, each accompanied by comprehensive text. Want to know the region to which a particular species is indigenous? Choose the map option and you'll see a detailed map of where that species lives. There's so much more to explore. This one's a keeper. (PC and Mac. Developer/publisher: Sumeria, 415-904-0880)—
Diana Phillips Mahoney

CDs of Note



people play, the other controls one of six "evil" robots. The ultimate challenger—the Supervisor—can even morph; she can, for example, form anvils and spikes for hands and feet. Ouch! Available now.

Already available for Sega CD, *Loadstar: The Legend of Tully Bodine* from developer Rocket Science Games makes it to the PC CD. The game's

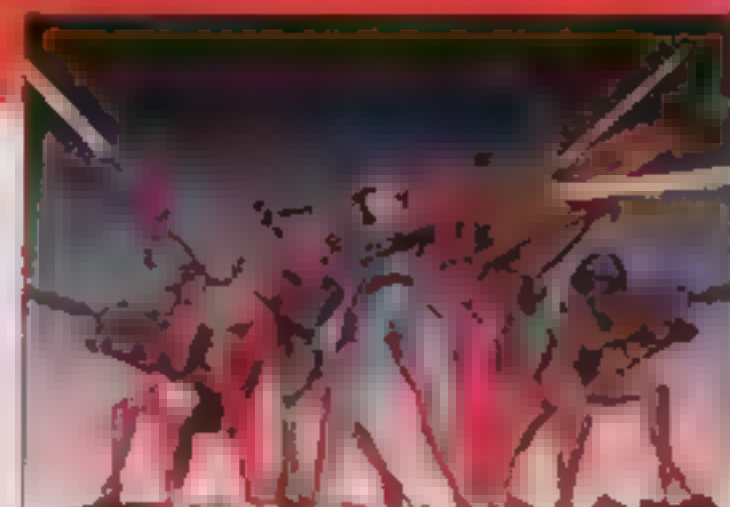
stunning 3D graphics really benefit from the extra horsepower, too. As captain Tully Bodine, you have to get a cargo of contraband camels off the moon. Dodge naval truckers, accidents



and Sheriff Wompier while winding your way through a maze of tracks. Expect a port to the 3DO later this year. PC CD expected Q1 1995.

MIT Media Lab graduate Ayshe Farman-Farman wrote and produced *Circus!* (published by Voyager), an interactive learning adventure for children. Children can choose to participate in eight acts, including teaching elephants to dance or shooting hoops with lions. Or they may decide to explore backstage, where they can choose from even more activities such as playing various instruments or trying out make-up and costumes in the Clowns Trailer. Available now.

Inferno: The Odyssey Continues (from Ocean of America) is Digital Image Design's sequel to its *TFX* flight



simulator. A team of 3D specialists spent 12 years—that's right, 12—developing and tweaking this space-combat simulator. Developers used 3D graphics, polygon mapping techniques, cinematic effects, and an original digital soundtrack by cult band Alien Sex Fiend to create as lifelike a combat simulator as they knew how. There are more than 700 missions on this CD, and it reportedly would take a good game player more than 130 hours to play them all. Available now.

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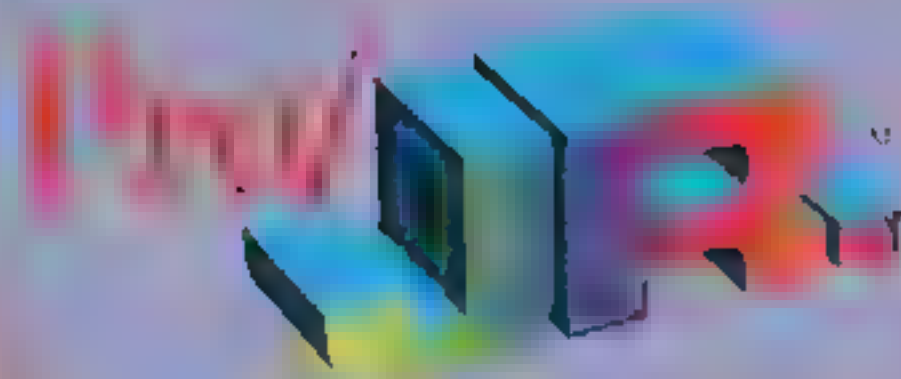


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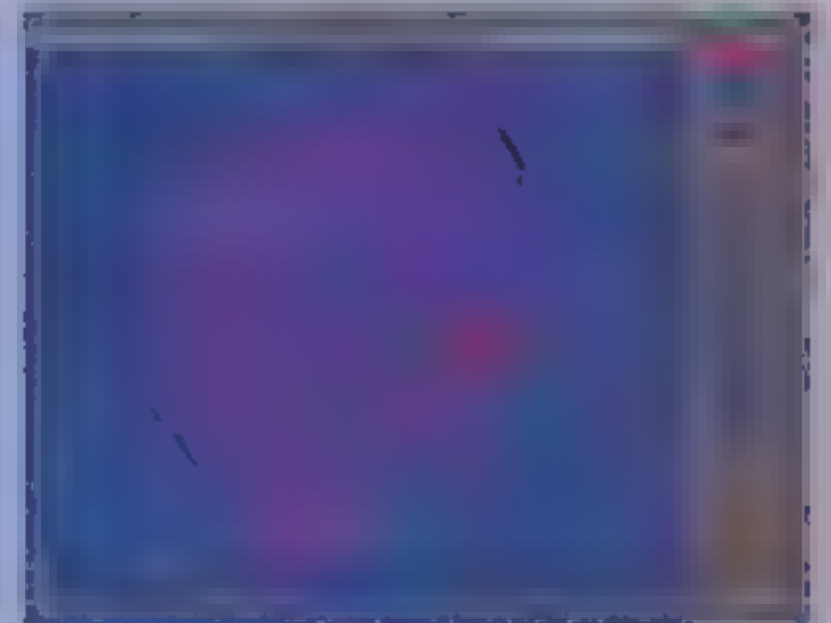
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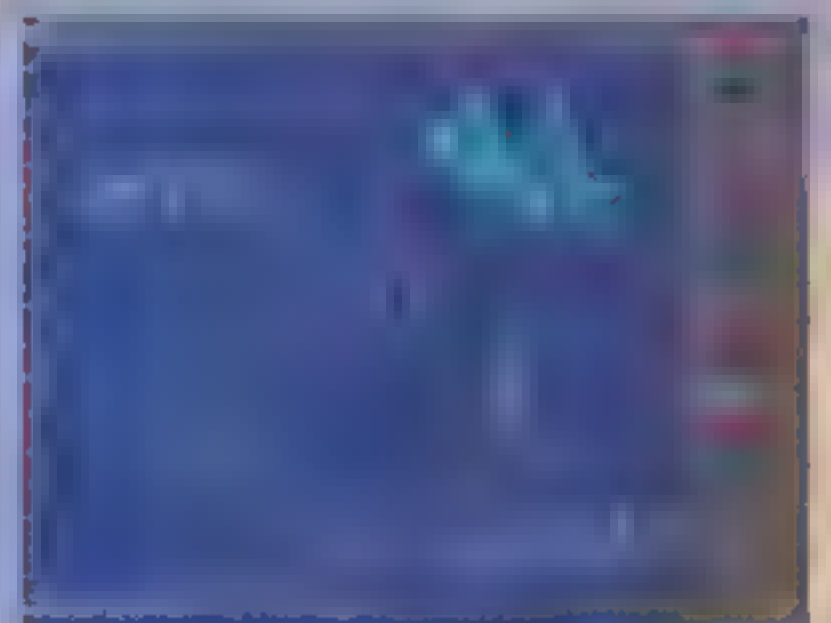
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CIRCLE 11 ON INFORMATION CARD



3D CONQUERS THE PC

3D on the PC. Not a new idea, but also not a viable concept, either—at least not for people who weren't willing to spend twice as much for an add-in card as they spent on their entire PC. But over the past year, technological advances in both hardware and

BY DONNA COCO

software are turning naysayers into believers. No, you won't get an SGI Indy for the cost of a \$1500 add-in board. But you will see aspects of your 3D design work noticeably

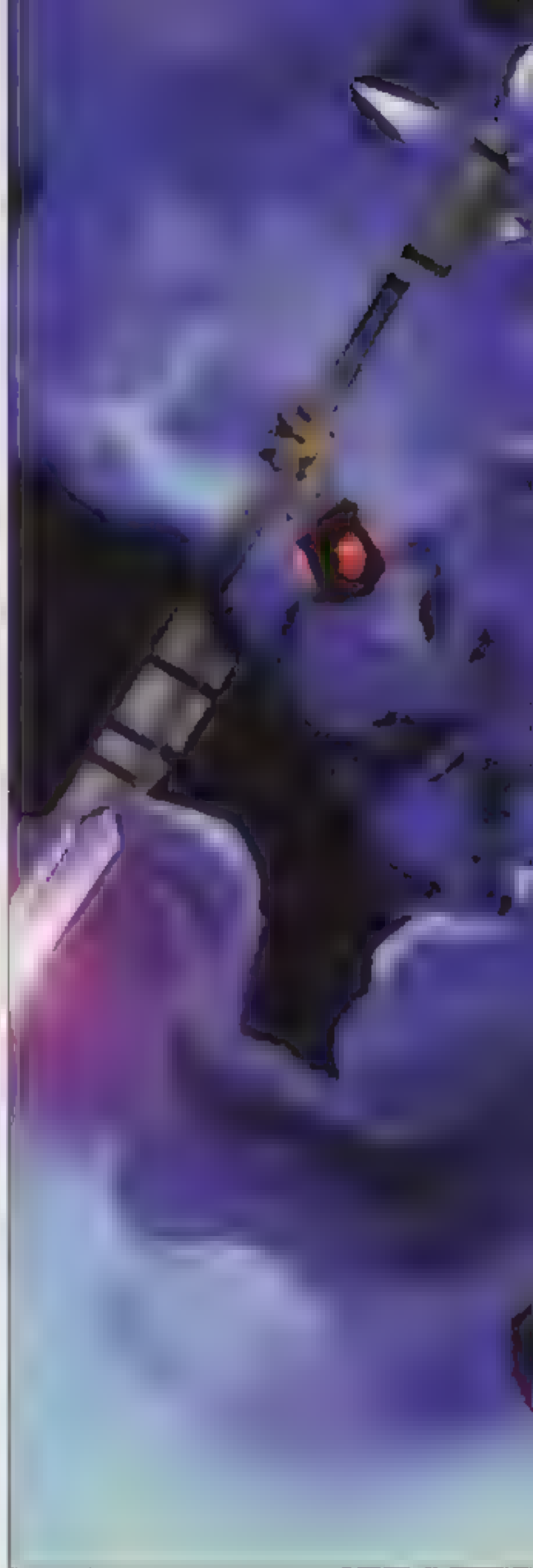
accelerated. And you also will see consumer-level 3D accelerators by the end of this year opening markets for 3D developers of all kinds. Plus now that all the pieces are in place, 3D on the PC can only get better—and vendors promise it will.

There are several factors driving the devel-

opment of products for 3D on the PC: faster CPUs with built-in floating-point units (FPUs), faster system buses, and emerging application programming interfaces (APIs) are three developments commonly cited by participating vendors. The arrival of 32-bit operating systems, like Microsoft's NT and upcoming

Windows 95 as well as IBM's OS/2 Warp, will play a part, too, especially in the CAD arena. Combined, these system advances have convinced semiconductor vendors that it's time for 3D accelerator chips. In turn, the availability of 3D chips has spurred the announcement of a growing number of 3D accelerator boards.

How all these developments relate to 3D on the PC varies. In general, vendors break the 3D process into three main operations: geometry (or transformation), lighting, and rendering. Most board vendors are leaving the geometry and lighting operations to the host CPU. That's because these functions are floating-point intensive, and with the introduction of the 80486DX from Intel, CPUs now incorporate FPUs. By leaving these operations to the CPU, board vendors eliminate the need for an on-board FPU and thus, can bring down the cost of 3D accelerators tremendously. Dan Wood, manager of technical marketing at Matrox Graphics (Dorval, Quebec), explains, "Floating point gives you higher precision in matrix multiplies, and you need a high degree of accuracy [in 3D operations], or you won't get results that fool your eye into seeing 3D. In the older architectures, before the 80486DX, there wasn't an FPU on the CPU. Matrox use to make a 3D board, but these boards use to alleviate the host from everything. They



had DSPs [to do the floating-point operations] and a rendering engine, and they'd cost \$6000."

In line with this thinking, most vendors of 3D accelerators are focusing only on the rendering phase of 3D computing, offloading the CPU of these computations. Some board vendors, like Matrox and AccelGraphics, have developed their own 3D rendering engine as well as the accelerator board. Other board vendors are buying 3D accelerator chips from companies like 3Dlabs, Cirrus Logic, Trident Microsystems, Yamaha, and Artist Graphics. The availability of these low-cost 3D chips, which promise to serve a variety of applications from CAD to game play, will also help keep board costs down.

It's finally happening: High-speed buses, common 3D APIs, powerful CPUs, and 3D accelerator chips combine to bring 3D to the PC

Donna Coco is associate editor of CGW



Today's faster CPUs—like Intel's Pentium, DEC's Alpha, and Motorola's Power PC—also have sparked interest in 3D development. Says Gary Kellar, director of video product marketing at STB Systems (Richardson, TX), "CPU performance has been lacking; processor speeds weren't fast enough. But we've seen speeds increasing to 90MHz and 100MHz—even achieving 150MHz. That's approaching acceptable levels of horsepower—at least for the low- and mid-range workstation users to consider the PC."

Yet another enabling technology is the PCI bus and, some would add, the VL bus. These 32-bit buses replace the old 8-bit ISA bus, dramatically increasing system band-

width, which is needed for processing the large amounts of data associated with 3D. "The ISA bus with its low bandwidth was a bottleneck," notes STB's Kellar. "The basic premise was to do as little as possible across the ISA bus. Hence you put the FPU on the graphics card, which drives up cost. Plus you have to do more of the 3D rendering process. Basically, you wanted the host to do as little as possible. PCI has given us a tightly defined mechanical and electrical bus that's processor-independent."

In part, it's PCI's processor independence that has a number of vendors siding with it over the VL bus. "With PCI, we're seeing a standard architecture that can be used across the Pentium, but that's also



Game-developer 47-TEK created these images for its 3D fighting games *Sento* (large image) and *Creep Clash*. Both games will run on 80486DX-based PCs with standard VGA cards, but they will also run at a higher resolution and increased color with a Matrox Impression 3D accelerator.

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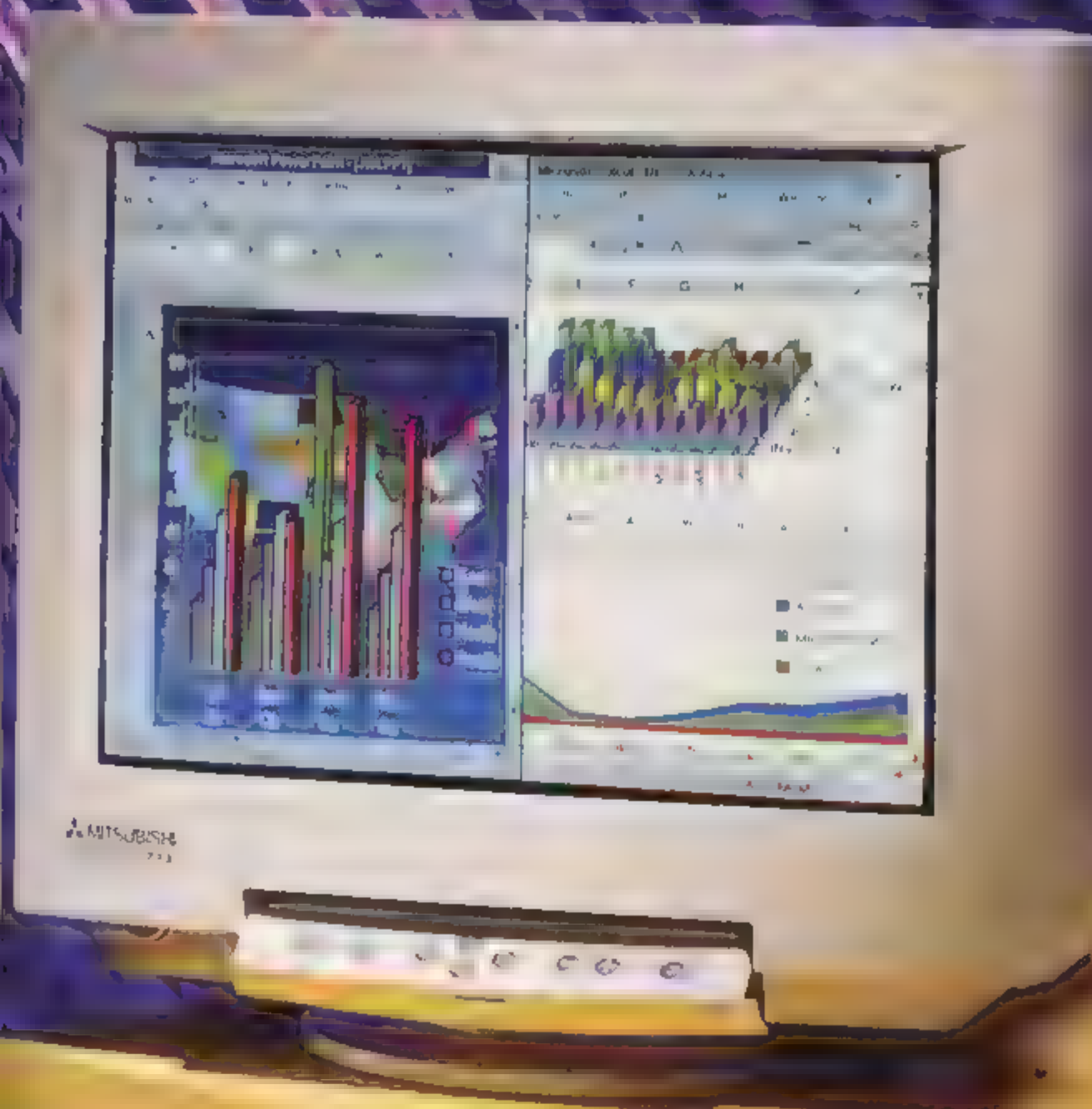
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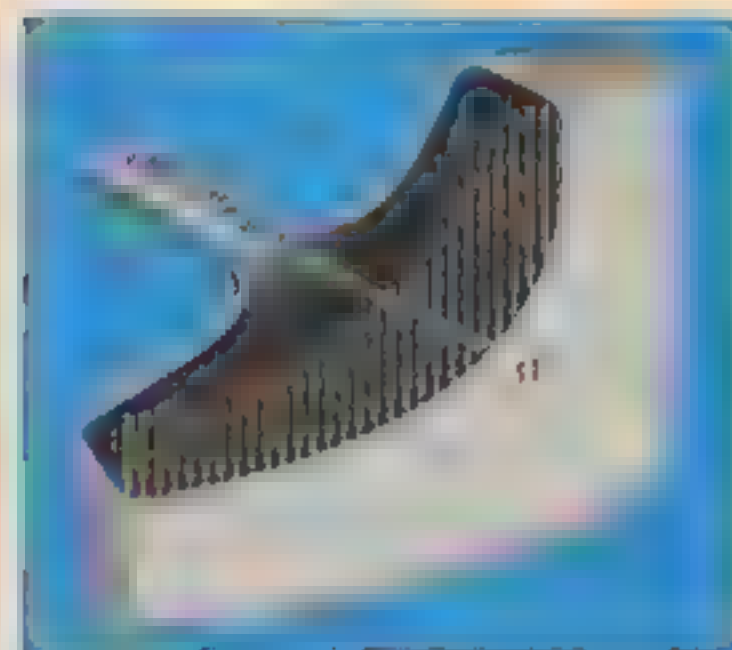
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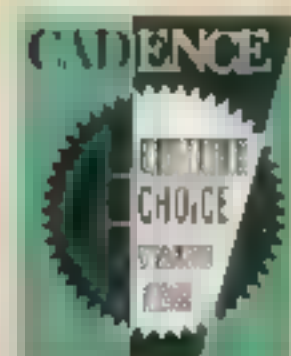


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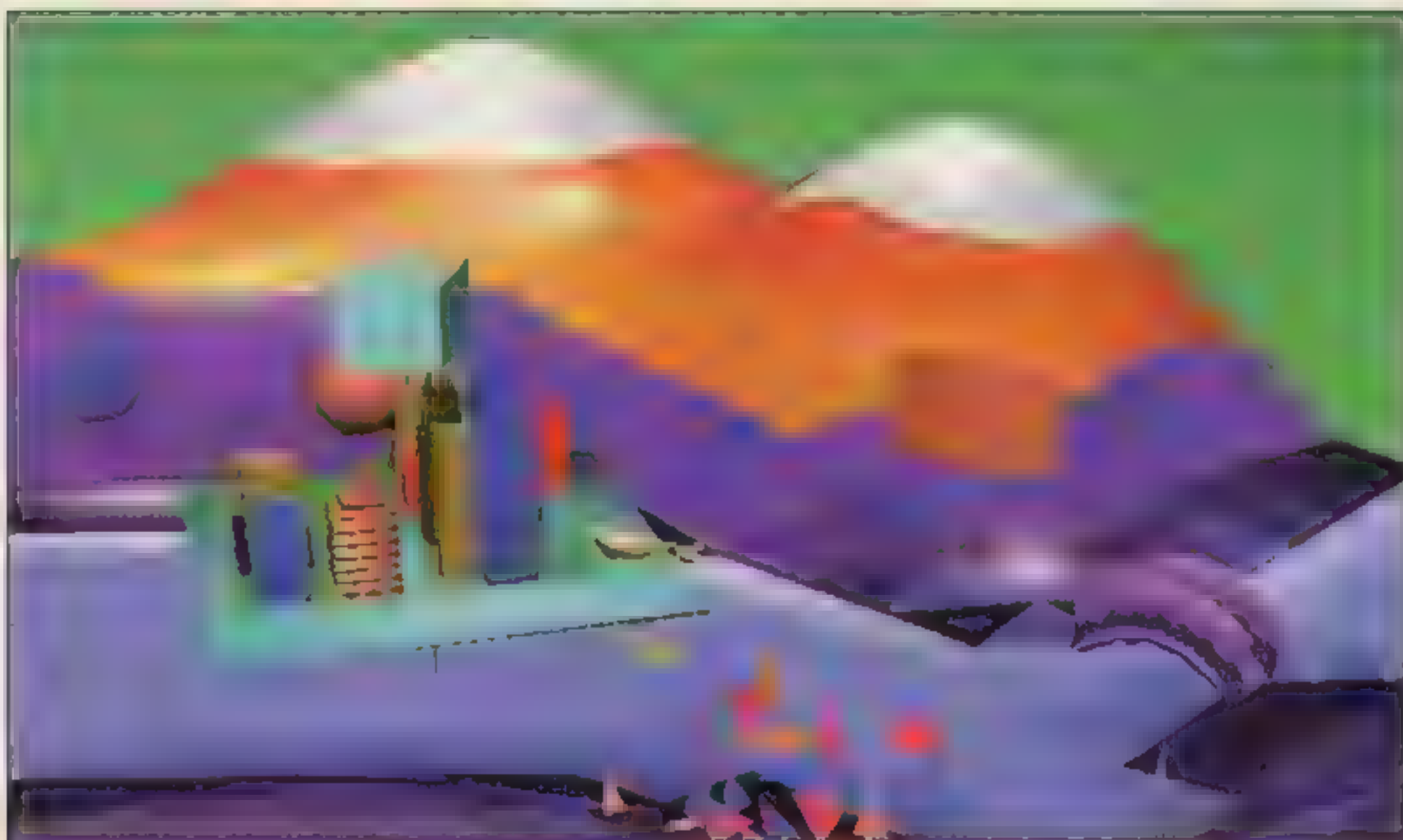
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CIRCLE 12 ON INFORMATION CARD



Duckworld (top image), developed by RenderMorphics using its Reality Lab 3D rendering library, is a simple game demo for the CD that accompanies Matrox' 3D Impression board. The polygonal Gouraud-shaded landscape is lit with colored light sources and rendered in real time. In the Spock image (bottom), Leonard Nimoy's face is chrome-mapped with a sunset; the same texture is used as a background. This image, too, is rendered in real time.

appropriate for other RISC-based CPUs, like the PowerPC, Alpha, Sparc, and MIPS based systems," says Kellar. "The VL bus was a good bridge [to PCI], but it was matched in design for the Intel type 80x86 architecture, and it's a bit more expensive from the system designer's point of view to implement on other architectures."

But hardware advances aren't the only factors pushing 3D development. The move toward 32-bit operating systems makes the porting of such CAD programs as Pro/Engineer from Parametric Technologies (Waltham, MA) viable. Parametric ported its CAD program to the PC when NT first came out about a year and a half ago.

"The main benefit of Windows NT is that it's a full 32-bit environment," says Olimpio DeMarco, manager of strategic relations at Parametric. "We were totally dedicated to the Unix platform before, which is also 32 bits. Regular old Windows, however, is a 16-bit environment. And there's no way to port down to that."

The other software factor driving 3D is the growing acceptance of various APIs as "standards." APIs provide a middle layer between application software and system hardware so that developers don't have to write a different version of their program for each chip on the market. Instead, they write to the API, and it communicates to the hardware. APIs also can accelerate 3D applications, even without hardware assistance, claim API developers. Says Kate Seekings, vice president of sales and marketing for 3D-API vendor RenderMorphics (London, England), "What we do is provide the whole of the 3D pipeline in software. Whereas the 3D acceleration people accelerate just the rasterizing portion of the pipeline, we handle the transformation and lighting quickly, too. Plus, our API will transparently take advantage of whatever hardware acceleration is there."

But don't expect to find just one API; there will be a number of APIs, if for no other reason than various

applications carry varying demands, and what would make a good API for a CAD program would not necessarily serve a game developer. For example, numerous CAD vendors support SGI's OpenGL (which Microsoft licensed for inclusion in Windows NT and Windows 95 and IBM for OS/2). But interested game developers would probably choose one of the three APIs aimed at game, VR, and simulation applications: Reality Lab from RenderMorphics, RenderWare from Criterion Software (Guildford, England), or BRender from Argonaut Software (London, England).

Neil Trevett, vice president of marketing at 3DLabs (San Jose, CA), developer of the Glint family of 3D accelerator chips, explains, "There's a range of APIs, and each one plays into a relevant area of opportunity. Currently, we support about nine APIs. For high-end SGI applications on the PC, OpenGL is the API of choice for the vast majority of vendors. The rendering pipeline in OpenGL is very precise so you don't get nasty artifacts. Looking at the lower end—game developers—OpenGL is possibly, and rightly, considered overkill. The binary is quite large, and it's too precise. The games people have a different set of priorities. The absolute preciseness of rendering isn't as important as fast iteration and low price. They'll give up accuracy to get the performance up, and it's a valid aim."

Trevett and others agree that it's up to the chip and board vendors to make sure their products are compatible with the various APIs.

Now that the hardware and software pieces of the 3D-on-the-PC puzzle are in place, what can you expect as a 3D designer? There are several answers, depending on how you work with 3D. If you are a CAD designer or an animator and

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CIRCLE 13 ON INFORMATION CARD



Looking Glass Technologies hopes to see games like its *Flight Unlimited*—a flight simulator with 3D planes and photorealistic 3D landscapes—accelerated by future generations of 3D boards. Because of its complex texture mapping, however, *Flight Unlimited* won't benefit from the current crop of 3D boards, which can only handle Gouraud shading.

you buy a 3D accelerator board, you will find that now you can work in shaded mode vs. wireframe and still move your model in real time. What these boards won't accelerate is the manipulation of the underlying models (transformation), the lighting, or the final rendering of a project. Most current products don't accelerate texture mapping, either. Rather, they accelerate Gouraud shading and Z buffering as well as some other associated functions.

Bob Bennett, 3D Studio product manager at Autodesk (Sausalito, CA), thinks it's important to emphasize these points. "People get real excited when they hear 3D. They think, 'OK, everything is solved,'" says Bennett. "But these cards are *not* going to offer any increase in speed of the final production-quality rendering. They are essentially accelerating the final portion of the 3D graphics pipeline—the rasterizing phase. They don't offer the production quality that would be needed for rendering out to film or video, nor do they accelerate the entire

pipeline. For example, they don't accelerate transforms. So when you're rotating, say, a car, and you want to rotate that model, the mathematical computation of re-computing the position of that model is not accelerated by these graphics cards. What they do hold promise of is being able to work in a shaded mode when editing or keyframing, which is a nice evolutionary step. This isn't any attempt to denigrate these cards—I just want to make clear what their promise is."

Of course, whether or not your

application will be accelerated also depends on whether or not the software vendors choose to support these boards. According to Bennett, there's no support for 3D acceleration in the current release of 3D Studio ("Keep in mind, reference boards are just now becoming available," adds Bennett). But Autodesk plans to take advantage of these cards with future releases.

Caligari (Mountain View, CA), developer of the Windows-based 3D modeling and animation package trueSpace, already has plunged into the 3D acceleration fray. With release 2.0 of trueSpace (expected soon), Caligari chose to support Intel's 3DR, an API focused only on rendering. And because Matrox supports 3DR, anyone with an Impression board will find trueSpace 2.0 accelerated. Again, what you get is the ability to work in shaded mode vs. wireframe. "It will be easier to orient yourself and to manipulate things," notes Roman Or-

Whither Workstations?

Each year PCs get faster CPUs, bigger memory and hard drives that cost less, larger and cheaper monitors—the next thing you know there will be 3D accelerator boards, and you'll have a workstation for the price of a PC. Right?

We'll, not quite so fast. Although privately some vendors of 3D accelerator boards already are laying SGI (Mountain View, CA) and other workstation vendors to rest, others are taking a more reserved view of the future of workstations. They don't see workstations—even the likes of the Indy—disappearing anytime soon. That's because workstations like SGI's are built from the ground up to support 3D. Hock Leow, vice president of video product marketing for Creative Labs (Milpitas, CA)—which happens to be working on a 3D accelerator board for release in the second half of next year—explains, "When you're working on an SGI, 3D is the total pipeline—it's total determination from beginning to end. What we're really looking at with 3D on the PC over the next 12 months is one part of what that whole SGI is doing. We're still leaving transformations and calculations to the CPU. Until those parts are incorporated into the PC environment, there will always be a clear separation of workstation and PC."

Naturally, the folks at SGI agree. Pat Pickie,

product marketing manager for next-generation systems at SGI, says, "We've spent ten years building graphics workstations, focusing on both hardware and software. We have fast system and memory buses, and 3D really depends so much on high bandwidth. Then there are all the other system issues—and I mean a I/O in general—including disk I/O. The other piece that's a little harder to get your hands around, but has a lot to do with our performance, is software. Again, we have a software investment of more than ten years, in both the GL library as well as our version of the Unix OS. We've tuned everything to 3D."

Anyway, SGI thinks the migration of 3D to the PC is good, says Pickie. "There's been a lot of talk among users and the press about competition. But we think the migration of 3D to the PC is a good thing. We've been involved in visual computing and making 3D a pervasive technology for years. It's the mantra that we've been carrying forward for the last decade. That's why we did things like license OpenGL to Microsoft. And as people start playing with 3D, it will make 3D more attractive to them, and they'll want to do more."

And buy an SGI? Guess we'll just have to wait and see.—DC

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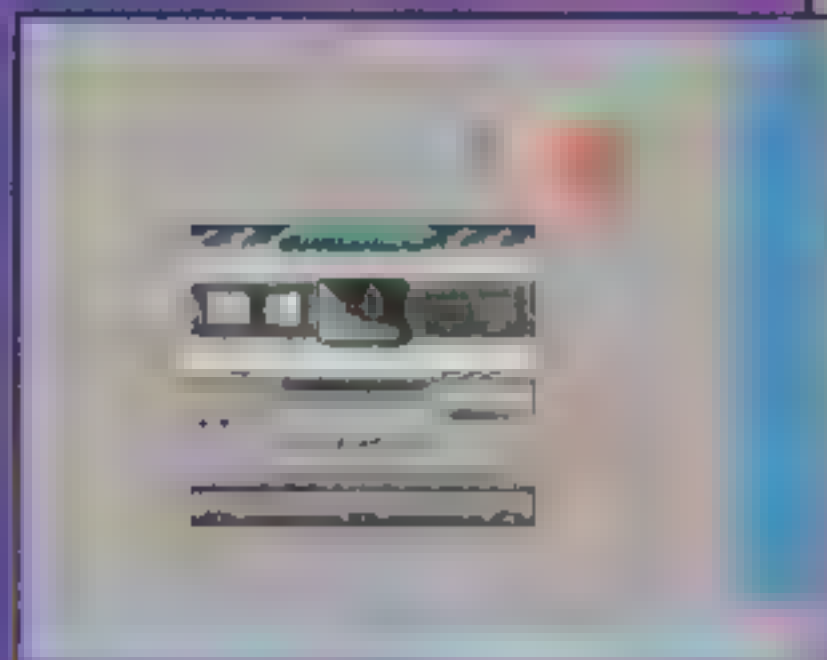
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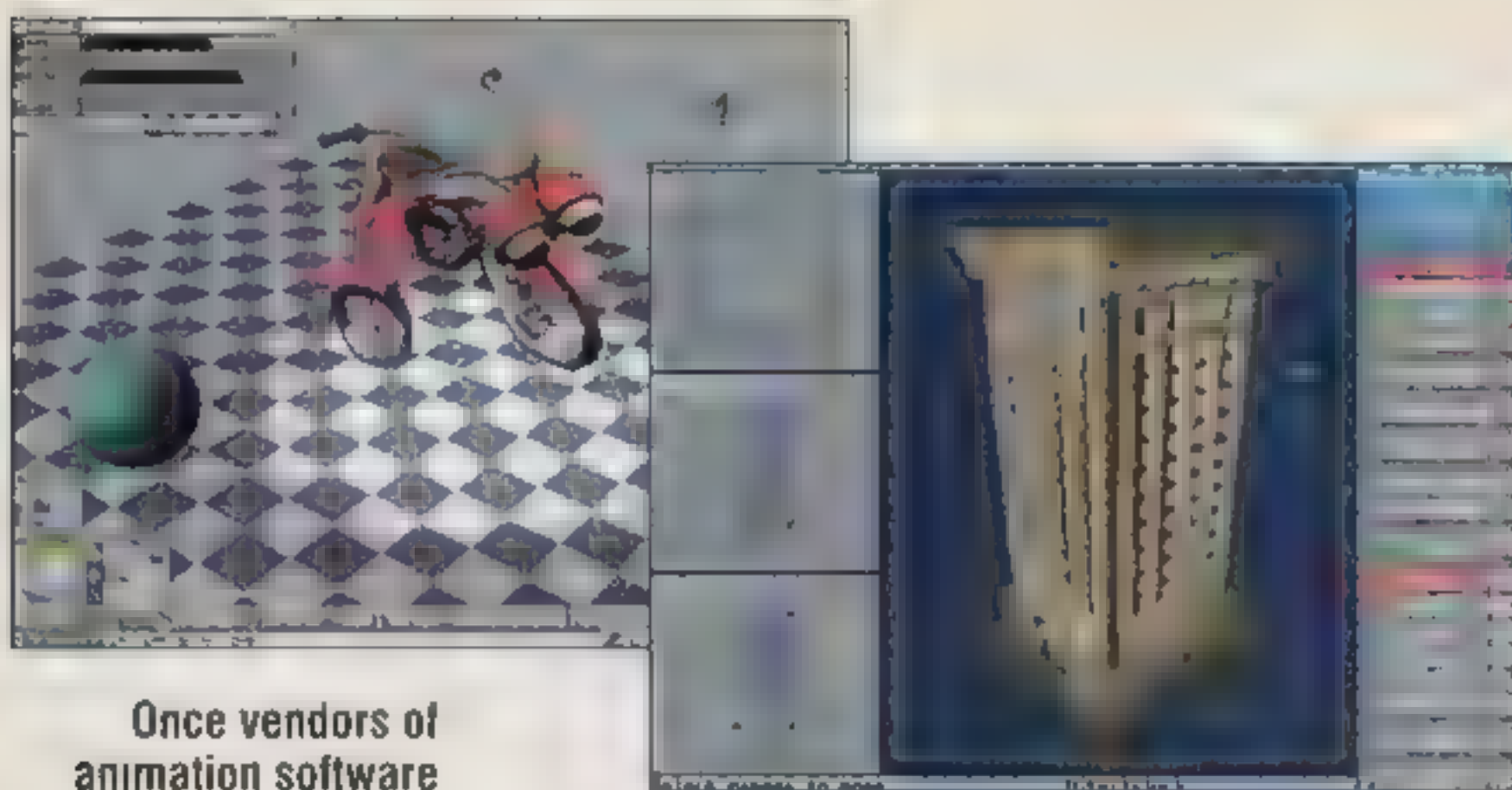
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Once vendors of animation software take advantage of 3D accelerators, users will be able to work in shaded mode instead of wireframe and still get real-time interactivity. Caligari will provide support in release 2.0 of trueSpace (left image), and Autodesk plans to support 3D acceleration in a future release of 3D Studio (right image).

mandy Caligari's president

Basically, the same holds true for CAD applications. If the vendor of your CAD package chooses to support these 3D accelerators, then you should be able to work in rendered mode. Autodesk is exploring such options for AutoCAD, as is Parametric Technology for Pro/Engineer. In fact, AccelGraphics (formerly Kubota; Santa Clara, CA), vendor of 3D accelerator cards, demonstrated Pro/Engineer accelerated on the PC at last fall's Auto-

fact. "People in CAD look at PCs differently," says Greg Milliken, vice president of marketing at AccelGraphics. "There's a perception barrier of 'I can't do this kind of work

on the PC.' People were surprised at what we had done."

If you are a game developer, creating 3D worlds that will run smoothly on PCs is becoming more viable than ever. Companies like two-year-old 47-TEK (San Francisco) already are out there with 3D games, including its two arcade-style fighting games, *Sento* and *Creep Clash*.

47-TEK was founded solely to develop 3D games, says Mark Hirsch, president. "We knew that 3D is the

trend for the future," he says. "We considered developing for other game consoles, but the PC was the most accessible and stable platform for us at the time. Back then, we promoted high-end 80486 usage. Then, of course, the Pentium came out, and now prices have dropped and dropped. All this just strengthens our strategy even more."

47-TEK uses the Renderware 3D API from Criterion to develop its games. "Our strategy was to be responsible for all the design, content, and applications, but we didn't want to develop our own low-level 3D engine. We decided to let the companies completely dedicated to that side do their job. It's just too hard to keep up on everything—especially when these API companies are making these cross-platform tools. Because our 47DO engine is built on top of the Criterion API, we were able to port from DOS to the Matrox card in about four hours. And right before Comdex, we ported to the Yamaha card in about an hour and a half."

Sento, 47-TEK's first game on the market, shipped with Matrox's Impression Plus board using it for acceleration. But the company developed another version that can be played without the Matrox board. Says Hirsch, "We've taken *Creep Clash* and *Sento* and put them on one CD. On that CD, you have the standard VGA versions that run at 320x240 in 8-bit color, or if you have the Impression board, you can play the Matrox-capable versions that run at 640x480 with 65,000 colors."

In general, accelerator boards let users run 47-TEK games at higher resolutions with more colors, says Hirsch. "The actual movement of the characters—the transformations and rotations—are still done by the host processor. But as game developers, we can adjust the number of frames and polygons in

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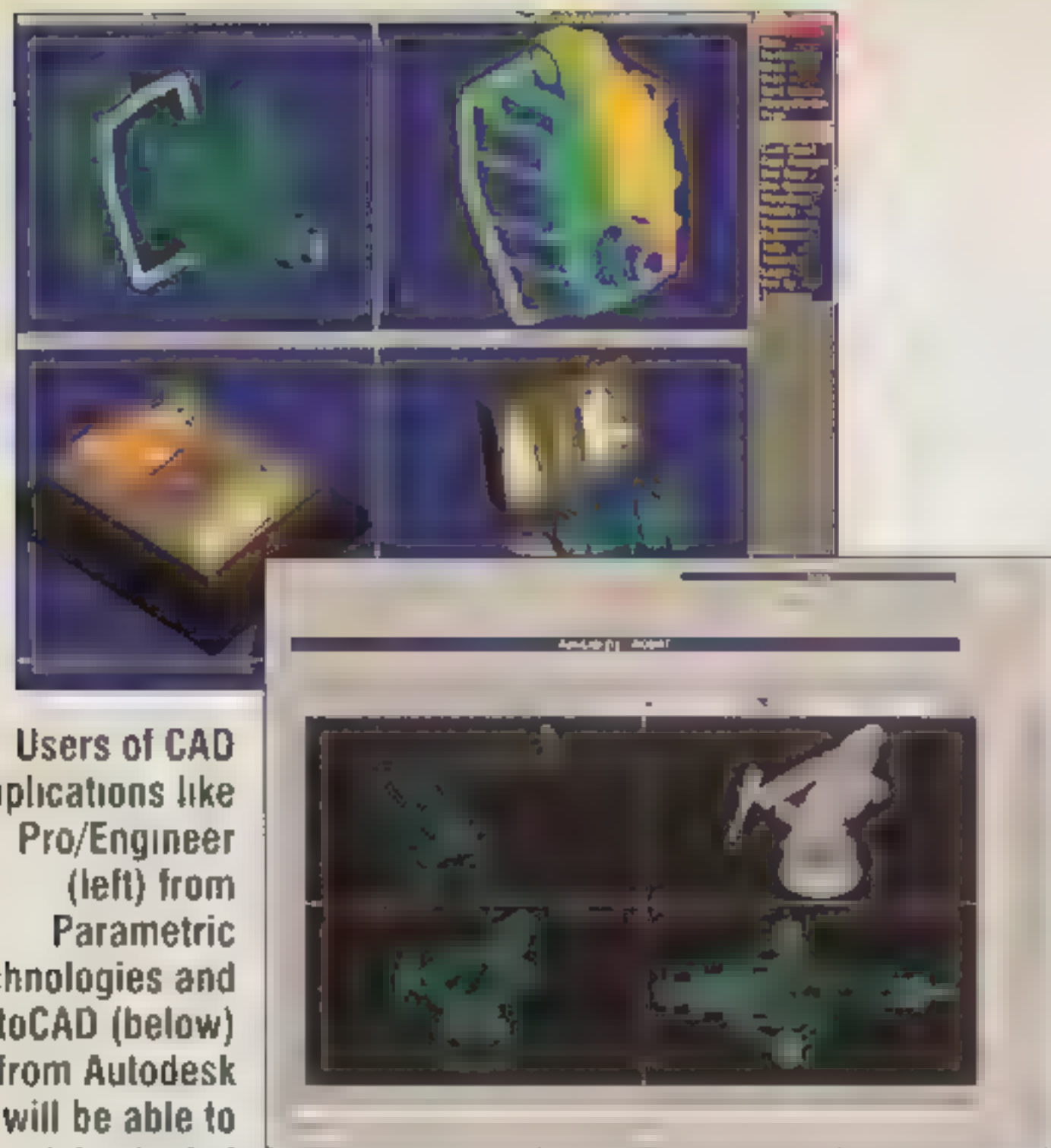
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Users of CAD applications like Pro/Engineer (left) from Parametric Technologies and AutoCAD (below) from Autodesk will be able to work in shaded vs. wireframe mode once support is provided for the soon-to-ship 3D accelerator boards.

a scene as well as a lot of other things to get the play action we want. If we could count on 3D acceleration, then we could operate at a high res, high color all the time, and we could create experiences that are much more movie-quality. We would really love for everyone to have accelerators.

Designers at Looking Glass Technologies (Cambridge, MA) have been developing game titles since 1982. "Even back then, we were always trying to squeeze a gallon of performance out of a pint of hardware," says Paul Neurath, president.

Looking Glass' first title under its own name (previously, the company did most of its development for other producers) is *Flight Unlimited*. The game is a flight simula-

tor, in which players fly 3D planes in 3D, photorealistic environments. "We do everything in software," says Neurath. "To do this, we have written lots of optimized, specialized code. We have a number of specialists in 3D rendering on board. The thing is, we don't need to be too rigorous in game development—it's not a mil-spec flight simulator we're creating here. So we can cheat a little bit, and that helps us get some more performance out of the system."

The first crop of 3D accelerator boards, however, won't help Looking Glass, says Neurath. That's because Looking Glass relies on texture mapping for improved visualization, and most boards can only handle Gouraud shading. "Most of these boards are doing linear interpolation, and that doesn't work on texture mapping," says Neurath. "We have 14 different texture mappers, some of which have Gouraud shading, some of which are divide-per-pixel. We select a texture-mapping routine based on the scene. This ability is critical to getting high performance and good looks, and we're not willing to settle on either of those points."

That's not to say Looking Glass isn't interested in 3D acceleration. "Some companies working on the next generation of boards with whom we've had in-depth discussions are trying specifically to

address our needs. We need the ability to have very flexible 3D primitives, fast texture mapping, and true-perspective texture mapping, which means we need a fast divide routine. That's the real bottleneck. A number of these boards don't have a fast divide routine. We also would like some smoothing functions. One down side of texture mapping—there's never enough texture memory. If you have 4MB of RAM for texture mapping in addition to your frame buffer, that gets really expensive. One solution is to do some smoothing functions."

Continues Neurath, "My understanding is that there will be at least one or two accelerators in the second half of '95 that we will be able to take advantage of. And that's important to the performance of our games. We're hoping—after seeing some of the initial specs on these boards—to get anywhere from a two-to four-fold increase in performance in our games. So for example, on a '486, instead of 10 frames/sec, we should be able to get about 20 frames/sec—and we would love to get that."

The question that still remains: Will consumers want 3D as much as the vendors and developers? Most initial boards are in the \$1000 price range and aimed at CAD engineers. But that price will have to drop to reach a mass market. Vendors predict this will occur by the end of this year or early 1996. In fact, they see 3D on the PC progressing in much the same way as the rest of the PC platform—improvements in performance and cost each year.

Says Matrox's Wood, "Basically as the technology advances, consumers will see more. The PC marketplace is not like that of the workstation—it's tough. There's more money to be made, so there are more players and it's more competitive. Competition means faster, higher res, higher color depths, faster turnaround, and more features. The consumer gets more, more, more, more. Today's solution is never enough." **C&W**

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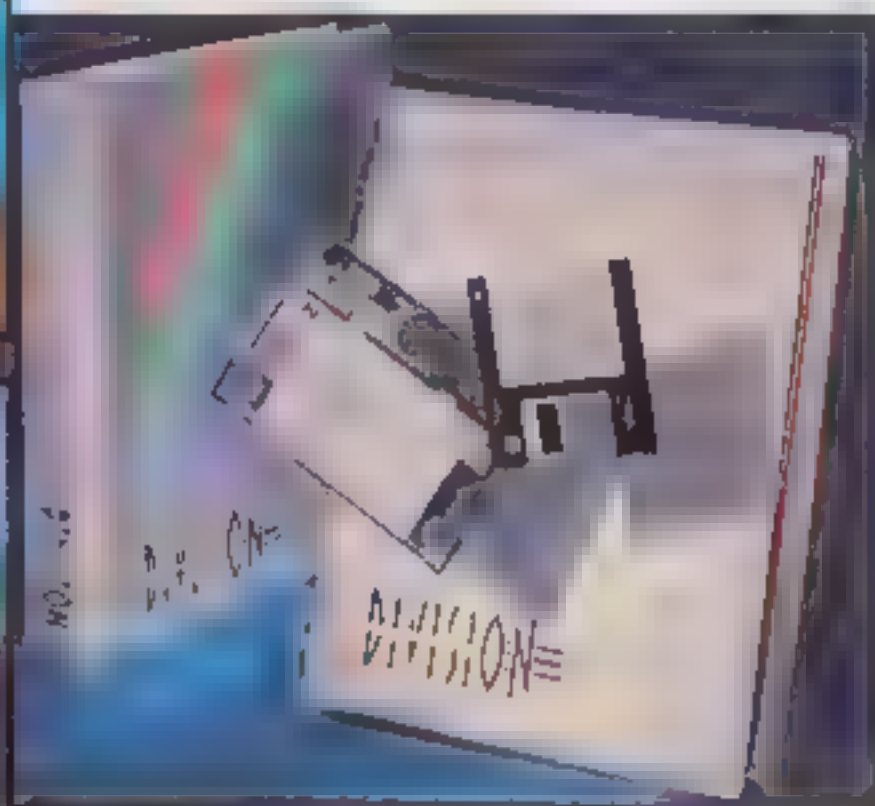
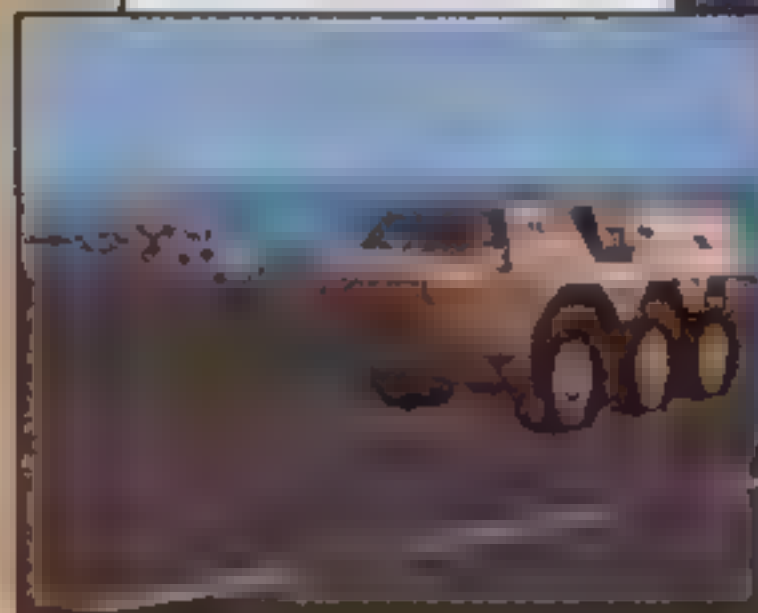


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BEHIND THE SCENES OF *DISCLOSURE*

It used to be hard to find a movie that uses computer graphics. Now, it's hard to find one not touched by CG. Hardly a month goes by without at least one animation/special-effects house having something to brag about on the big screen.

This month, we look at the role computer graphics played in the corporate thriller *Disclosure*.

For Warner Bros.' *Disclosure*, the artists and animators at Industrial Light & Magic (San Rafael, CA) cre-

Barbara Robertson is CGW's West Coast senior editor.

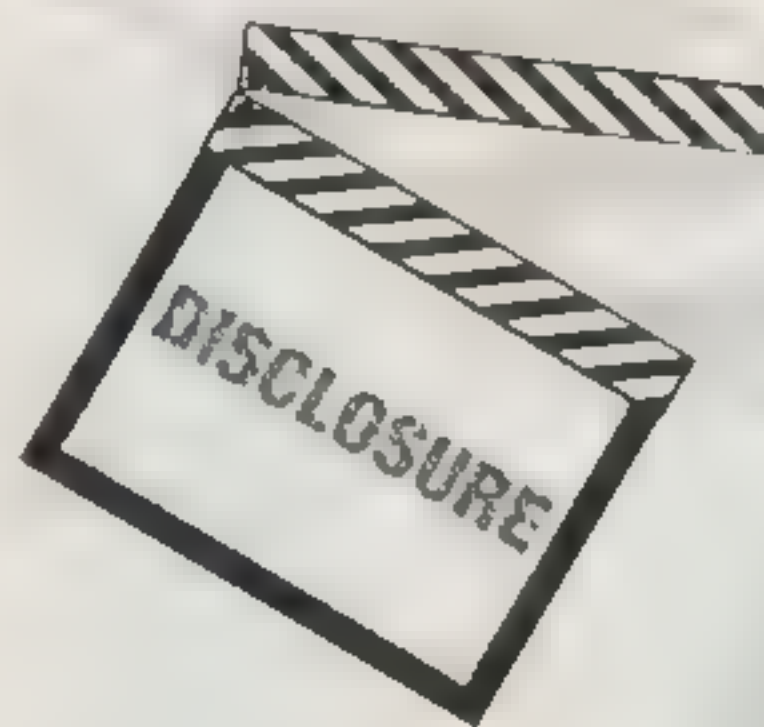
ated a virtual-reality setting and placed superstar Michael Douglas in the CG set. ILM's CG department, which has grown from a handful of people who worked on

The Abyss to more than 300 now working on several film projects simultaneously, uses commercial software from Alias (modeling), SoftImage (modeling and

motion), Wavefront (particle animation), Pixar (rendering), and Parallax (painting), augmented with proprietary tools as needed—all running on Silicon Graphics hardware.

BY BARBARA ROBERTSON

ILM relies on computer graphics to create the pivotal VR scene in *Disclosure*.

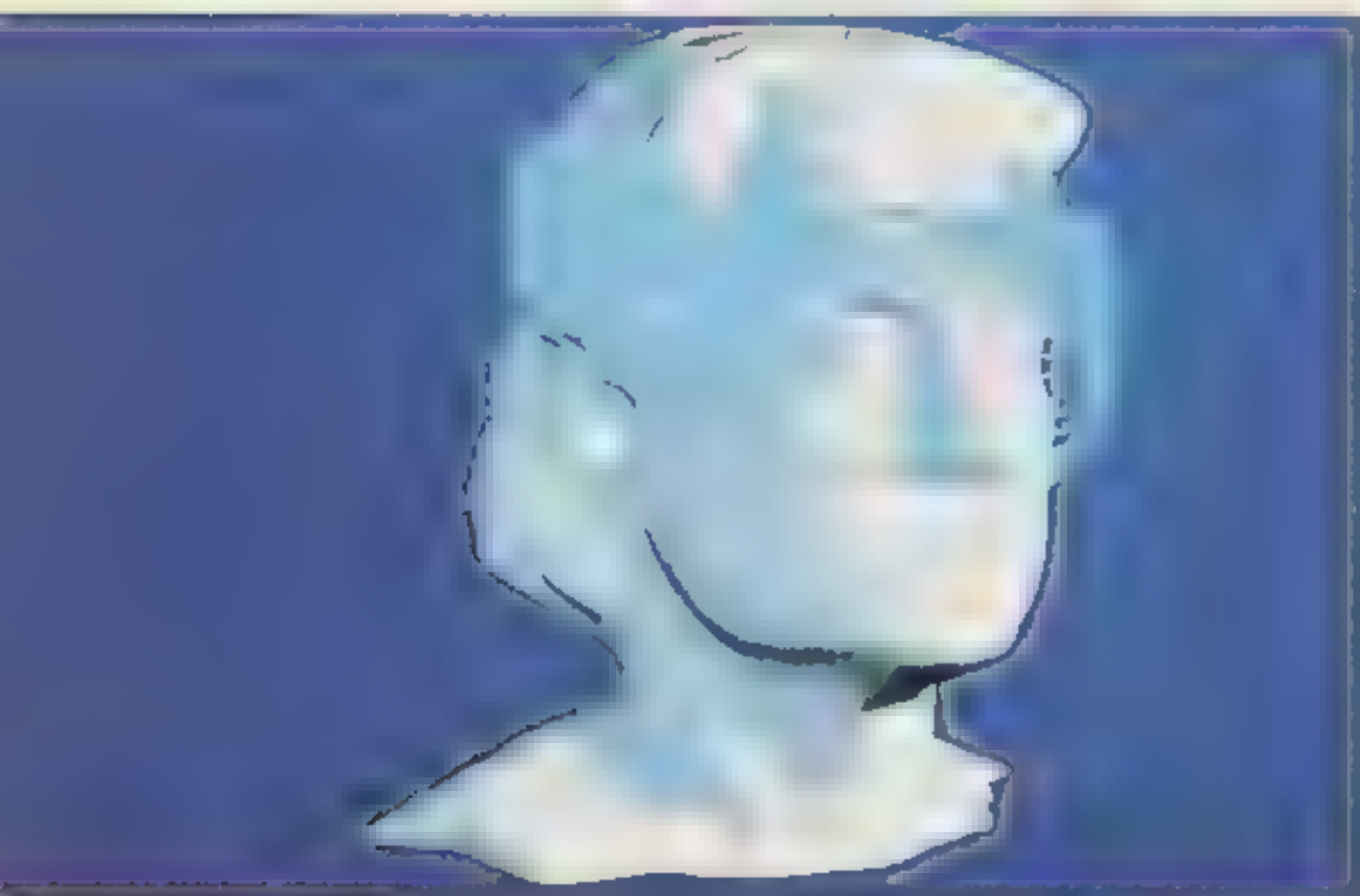


Now that computer graphics effects are well-accepted and even in demand for feature films, each movie that utilizes these techniques seems to spawn a new generation of CG applications. That seems especially true when the artists at Industrial Light & Magic are involved. In their hands, we've seen the use of computer graphics evolve from *Star Wars*-type special-effects objects into 3D

Looking through actor Michael Douglas' visor in the movie *Disclosure*, we see the main corridor of a virtual-reality environment. As Douglas "walks" forward, the hallways in front continue to form endlessly. The VR environment and interface (notice the X,Y,Z orientation icon) were designed and created by artists at Industrial Light & Magic.



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By creating a Cyberscan of Douglas' head, ILM modelers, animators, and compositors could use the resulting 3D model to help create a 3D visor (bottom image) and to help match the camera moves from bluescreen, live-action shots with their work (top image). They also used the Cyberscan model as a matte to block out the "other side" of the 3D visor on the live shots of Douglas' head. The visor and environment were modeled with SoftImage software. The 3D "wireframe" mannequin, the second object in the top image, was created with Alias software.

characters with starring roles; from the obvious to the subtle. The pseudopod in *The Abyss* begat the special-effects character in *Terminator 2*, which begat the awesome dinosaurs in *Jurassic Park* and the promise of a starring role for 3D characters in *Casper*. ILM artists have altered people in grotesque yet believable ways in *Death Becomes Her*, in totally believable but couldn't-have-happened ways in *Forrest Gump*, and in purposefully, outrageously, un-

believable ways in *The Mask*. With each movie, computer graphics has become more essential, more integrated, more central to the development of the story.

The effects in the movie *Disclosure* will also serve to change how people might view the application of computer graphics in movies—although in this case, it will more likely be as a by-product of the actual purpose of the scenes rather than as a duplication.

Disclosure, based on the best-selling novel by Michael Crichton opens with the news that Meredith Johnson (played by Demi Moore) has just received a promotion everyone thought was slated for Tom Sanders (Michael Douglas). Johnson, the epitome of the cold, calculating female executive sexually harasses Sanders, basically a nice guy, then accuses him of sexual harassment. Further, she causes him to lose points at a corporate meeting the following day. Sanders spends the rest of the movie fighting back and trying to discover what's really going on.

One thing going on is that the programming team at this company, DigiCom, has created a virtual-reality environment, and the team leader, Don Cherry (played by Nicholas Sadler), put the company's database into it. It's this environment that the ILM team was contracted to build.

"My first concern was that it

was a little far-fetched to have a VR scene in a corporate thriller," says Eric Brevic, visual-effects supervisor at ILM for *Disclosure*. "I didn't want *The Firm* with *TRON* cut into it by mistake."

Given that critics, reviewers, and moviegoers spend more time talking about the steamy sexual harassment scene between Moore and Douglas than about the technical tricks in the movie means ILM did its job well.

Although the two VR scenes occupy little on-screen time—about a minute for an introductory sequence and about five minutes for the major sequence toward the end of the movie—the actual "disclosure," the pivotal point in the movie, takes place in virtual reality.

At first, the ILM team planned to show VR as it really exists. "Little by little, we realized that wasn't the goal," says Brevic. "Current technology is way too boring. We needed to make it visually exciting."

In the pivotal scene, Michael Douglas steps onto a walker pad and puts on a visor and gloves. As a laser beam scans him, the VR system starts to "res on." We see his hands, then his head, appear as 3D shaded models. In the background is visual static. When he presses a "start" button, the static disappears and a huge, cathedral-like building begins to form in front of him. As we watch Douglas walk down the corridor, we see hallways continue to form into infinity. He turns a corner and nearly falls into an unfinished, Escher-like construction. The camera takes us back to reality and we see him on the walker pad trying to regain his balance.

With our camera again back in VR, we can watch Douglas round a corner and enter a room whose walls are lined with drawers. File drawers. He touches a label and the drawer pops out. He touches a file and sheets of printed docu-

ments fly up in front of his face. Suddenly, a wireframe model of a woman with a photo ID picture of Moore appears. She's in the file system, but not in VR; that is, he can see her, but she can't see him. She's deleting files. Douglas asks for help, which appears in the form of a flying, talking 3D angel. Douglas has just enough time to look at a video teleconference before someone comes into the room and he has to run.

Here are some of the details the artists and animators at ILM had to deal with to create this sequence:

- Because the script called for only Douglas to be in virtual reality (the book had both Sanders and his attorney in the environment), they couldn't show him from the point of view of another person. Instead, they conceived the idea of an omniscient camera. But Douglas is a famous, handsome, and expensive actor. "They wanted to see him reacting," says Kim Bromley, visual-effects producer. Unable to have a visor covering half his face, they turned the visor transparent when Douglas is in VR. Because of the numerous close-up shots, they made the visor more transparent around Douglas' eyes, sometimes changing the transparency on a per-shot basis. "Using a Render-Man shader," explains Ellen Poon, computer graphics supervisor, "we'd create a vertical and horizontal ramp in 3D space to get the right combination of vertical and horizontal transparency."

While the transparent visor solved the problem of keeping the star in full view, it created other problems. Matching the visor to the live-

action, bluescreen shots of Douglas "caused hours of agony in post," says Brevie.

- Because the movie was on a very fast track, they filmed the bluescreen shots in May, before building the VR environment, before, in fact, the first week of photography on the movie. They delivered final shots five months later. Since Douglas is in nearly every shot on which the effects team worked, they tried to make the work as easy as possible. For example, knowing they'd need to match his moves, they put black witness marks on his face to help place the 3D visor later. Knowing the VR corridor would have marble floors, they filmed Douglas standing on a mirror to pick up his reflection. And, they put a 4x4-foot cube of 2x4s in all the scenes to help match the CG camera's perspective to the bluescreen camera.

- To help place the visor on Douglas' head, they did a Cyberware scan of his head, then, rather than go through what would have been "rotoscope hell," they used the resulting model as a matte object to block the side of the visor hidden by his head. Even so, "it was match-move hell," says Poon. "Human movement is so erratic."

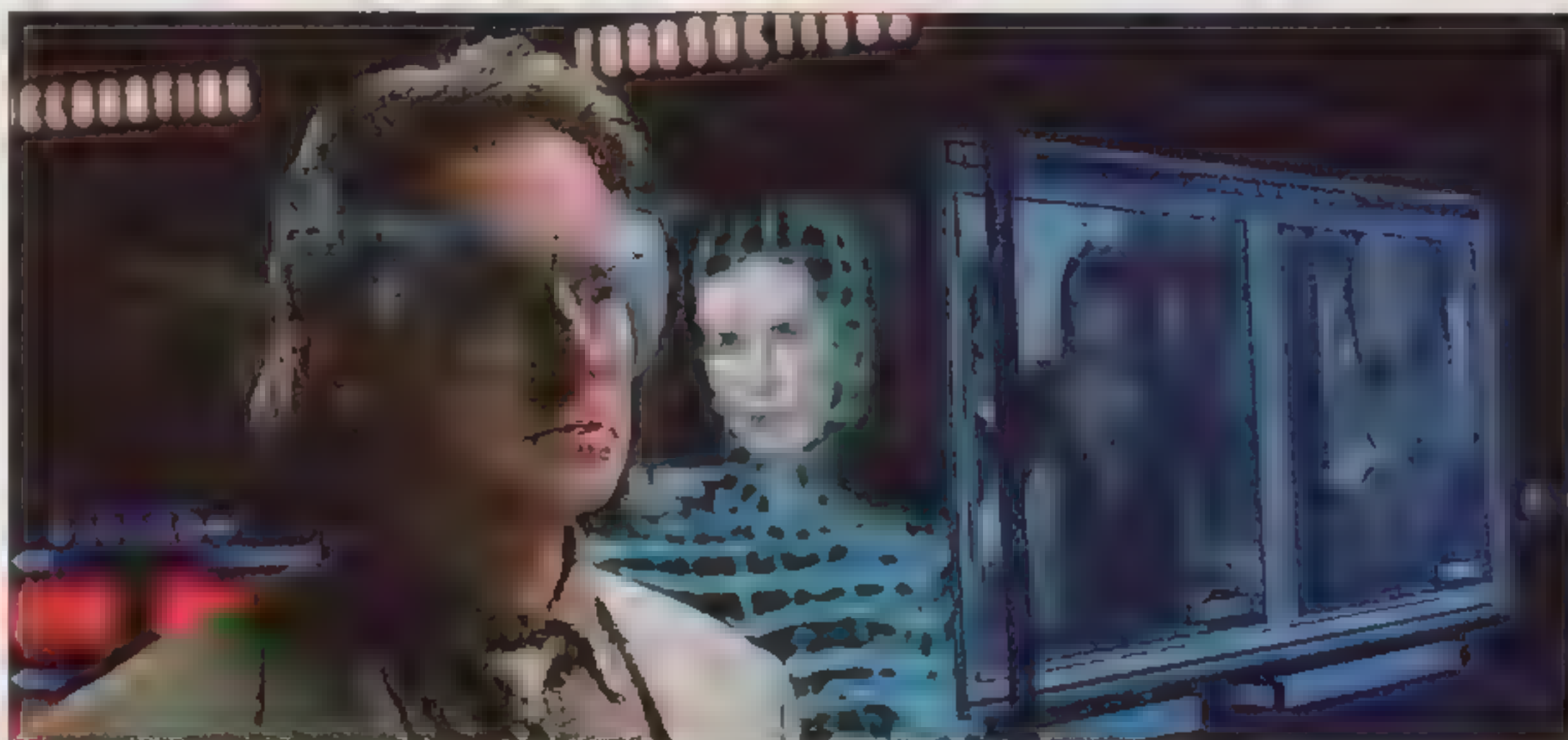
- To create Moore's stand-in, they wanted to use a wireframe model to represent a simple version of a real person. But the detail in a real 3D wireframe didn't produce the look they wanted. So they texture-mapped a "wireframe" painting onto a transparent solid.

- For the environment, they had to decide just how far they could go, given possibilities ranging from the relatively crude graphics in existing VR to photorealism to a fantastical science-fiction

In these images, we see the making of one of the pivotal scenes in *Disclosure*: forming the file room in VR, positioning the mannequin, adding Demi Moore's "photo ID" to the mannequin, placing the videotapes side by side on the VR monitor stand, and finally, inserting the live-action shots of Douglas wearing his transparent 3D visor. Moore is represented in wireframe because Meredith, the character she plays, is accessing the same file system as Douglas, but she is not in the VR environment. He can see her, but she can't see him.



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look often used for VR scenes

"We asked ourselves 'What would [DigiCom's programming team leader] Don Cherry do?'" says Bromley. "We decided he probably borrowed from photography books and art books." So they built a cathedral-like structure with marble floors, light streaming through windows, and paintings on the walls. But because they didn't want people to think they just went to a cathedral and shot the scene, they added "lazy" details

could have been all in focus always," says TyRuben Ellingson, art director at ILM for visual effects. Instead, "We used atmospheric changes and lens aberrations

● To give Douglas access to the DigiCom database, they created a VR metaphor for the real world: file drawers that open, printed pages that float in 3D space, and video screens that pop up in VR space. "We asked ourselves," says Bromley, "Would Mother understand? No? Would she like it? Yeah. Let's move

called the "Rossiter Effect."

● As for the angel, Michael Crichton's idea of interactive help in VR. "We got out all the angel references in the world, threw out most of them, and finally came up with a cross between a puppet and a Christmas tree ornament," says Brevic. Putting Don Cherry's face on the angel was, says Bromley, "our joke. We thought that's something a programmer might do."

"The director [Barry Levinson] was great," says Poon. He gave us a blank check to come up with the whole concept. We really thought it out and presented it to him. Usually, it's the other way around."

That was different. Another difference: They had a long scene to work with instead of many small shots sprinkled throughout a movie.

But the biggest difference is that instead of creating foregrounds that are put into live-action scenes, in *Disclosure* they built a 3D set around a live-action foreground. "We could change the mood of the environment," says Poon. "It shows to people that we can do a set. It's up to them how they want to play it. It's sort of like a dial. We can set it where we want—from electronic to very realistic."

Adds Ellingson: "It's a Renaissance time. The aesthetic is now the driving force, and the machines are in the background."

"I see in the future," says Poon, "movies where the environment is not conventional, like Kubrick's movies where the furniture is futuristic. We can push that further. We can go wild with design—photorealism, but with something that's not quite right. That you can't pinpoint. That's what I want to do."

She probably will. **C&W**



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In this scene, we see the VR representation of Meredith deleting files from the system. To create the "wireframe" model, ILM artists created a transparent solid, then painted lines and applied the "wireframe" with a texture map. Notice that throughout the VR scenes, the image of Douglas is "noisy" to help create the illusion that the audience is viewing an image created by a computer.

with 2D texture maps—details that help you know it's not a real place that convince you this is VR (since it isn't perfect). Also, they added details that could only happen in VR: the endless hallways, the vertical Escher hallway. "One of our goals was to do something you couldn't do any way other than with CG," says Brevic.

For example, explains Poon, animator Rob Coleman built the architecture, then took it all apart, breaking the geometry into groups and animating each group. The hallways don't grow from the ground up, nor does the file room. They come together like puzzles. "Like Origami," says Poon.

They also began playing with depth queueing in the virtual environment. "Because it was digital, it

on.' " It seems believable until you stop and think about it. "The last thing you would really do is walk a mile to get a file," says Brevic. "In reality, you would 'res in' and it would all be in front of you."

● To add to the illusion that Michael Douglas is in virtual reality, the animators came up with several tricks in addition to the transparent visor. Tom Rossiter worked with Poon to create a noise function that was animated throughout the entire shot of Douglas. As Douglas moves, his image seems to break apart as if the computer is lagging behind in creating his image. "The idea is that the system is still flawed enough that it seems plausible," says Brevic, "although the flaws are totally incorrect." Bromley notes that the noise function is now

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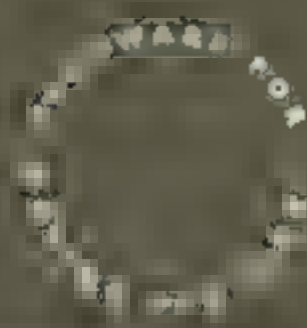
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CIRCLE 18 ON INFORMATION CARD

Apple Peripherals

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RAPID PROTOTYPING IN MEDICINE

The prognosis was bleak: The patient had a cancerous bone tumor in his temple area, and because the surgeon would have to access the growth via the frontal, highly functional area of the brain, the surgery would almost certainly result in the loss of vision in one eye and the impairment of some motor functions. Before proceeding with this surgical plan, however, the doctor took another look at the tumor, this time using a 3D plastic replica of the patient's skull. By studying the model, the surgeon realized he could get to the tumor by going up through the patient's jawbone. Thanks to this second look, the patient's eyesight and motor functions remained intact—the only thing he lost was one tooth—and, of course, the tumor.

The plastic model the surgeon relied on was created through a computer-driven rapid-prototyping (RP) process called stereolithography, which uses photosensitive

liquid polymers to fabricate digital models. The computer model in this case was generated by stacking sequential, 2D computed tomography (CT) scans of the patient's skull. The resultant 3D data-set was "cleaned up" via image processing, then interpreted, interpolated, and translated directly into a format that would be compatible with a stereolithography machine from 3D Systems (Valencia, CA).

The success of this real-life scenario earned a Belgian company called Materialise—the developer of the software driving the model generation—the 1993 European Stereolithography Users Excellence Award. It also serves as an example of the real and potential impact of rapid prototyping in the medical arena. Not only was the patient in this case spared physical disability and the emotional and financial price tags associated with that, but also the surgeon's awareness from the outset of exactly what to expect likely reduced the duration of the procedure, which in turn reduced the risk of infection as well as surgical costs.

While computer-driven rapid prototyping has been in use since 1986, the technology's potential has only recently begun to be exploited in medical applications. Examples of its use in this area range from

straightforward industrial-design tasks, such as the development of prototype medical devices, to the creation of custom implants and prosthetics to surgical planning and education.

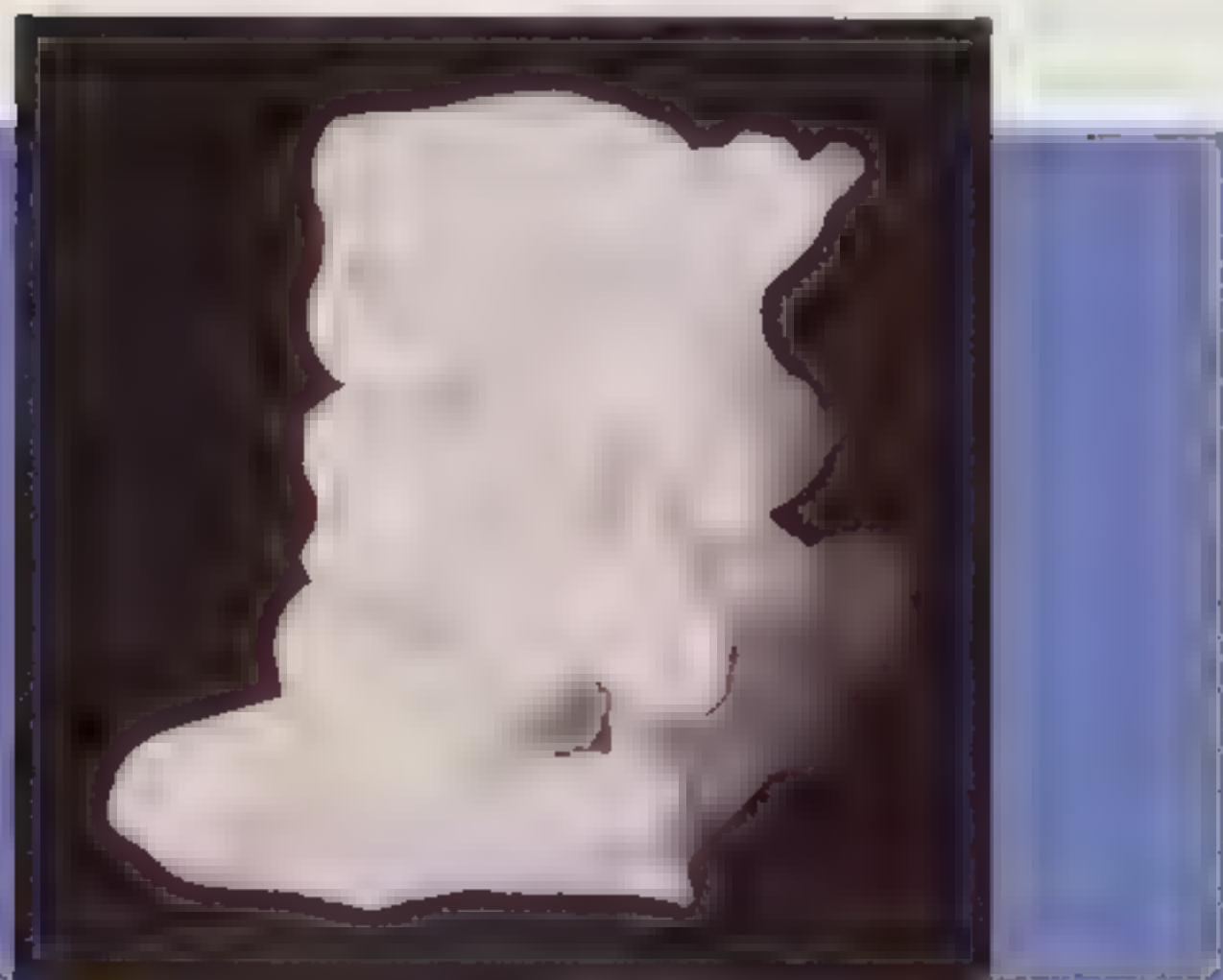
Not only does the ability to create accurate 3D parts (tolerances can be as tight as 0.003 inch) directly from a CAD/CAM model or scan data result in reduced product-development time and production costs, it can enhance the quality of health care, as illustrated above.

In the US, the bulk of medical applications of RP are industrial-design-oriented, such as the creation of prototype devices, implants, and prosthetics. For these applications, manufacturers generally rely on RP models for one of two purposes: to use as a master pattern for creating molded tooling, or to use as a visualization/conceptualization aid in the product-design process itself. In some companies, the technology serves both functions.

At Sofamore Danek, a spinal-implant company based in Memphis, Tennessee, engineers began incorporating rapid prototyping into their development process al-

Diana Phillips Mahoney is senior associate editor of CGW.

This model of a spinal implant was generated via a computer-driven rapid-prototyping process called fused deposition modeling, developed by Stratasys Inc.





This hand model was generated from CT scan data using Cubital's solid ground curing technology.

most two years ago, when the company purchased a Stratasys (Eden Prairie, MN) rapid prototyping machine, which relies on a process called fused deposition modeling (see "A Quick Look at RP Technologies," page 48). "We typically use it as a concept-development tool," says Troy MacDonald, engineering systems administrator for the company's US division. "In other words if we have a surgeon come in in the morning, and we discuss one of his design ideas or possibly a change on one of our implants, we can quickly make a part based on what we've talked about. Before the surgeon leaves in the afternoon, he can look at it and say, 'Yeah, this is what I want,' or 'No, this needs to be a little bit more this way or that way.'" Previously, the engineers would provide doctors with 2D drawings, which, says MacDonald, were sometimes misinterpreted or were inconsistent with the surgeon's original design intent. "Sometimes it's hard for people to understand what a 2D drawing is showing them. When you're able to give them a 3D part, they can grasp [literally] the concept a lot better. So it cuts down on a lot of the potential miscommunication."

Because the models are so easy

to generate, the Sofamore Danek engineers also use them for testing new design ideas. "We'll build some parts on the machine and just go through several iterations trying to get the best design we can. The Stratasys machine allows us to do this right here in the engineering office rather than having to send it out," says MacDonald.

The design process is fairly straightforward, according to MacDonald. First, the engineers create a solid model of the implant design in ConceptStation (Aries Inc.; Lowell, MA) and download the design as an .SIL file—the standard CAD-to-RP interface—to the Stratasys machine to build the part. Often, to limit the need for structural supports, the engineers will slice the model in half; then, once the pieces are built, they will glue the halves together. "After it's built, we do whatever's necessary to clean up the model, maybe a little filing. Then we'll show it around, to the surgeon or to the engineering group," says MacDonald. "We try to verify the design based off of that model, rather than going into a metal prototype. Once we feel comfortable with the design, we'll take it to the machine shop to have it machined [the implants are made of

stainless steel or titanium]."

In the implant business, the "rapid" in rapid prototyping is essential, says MacDonald. This is particularly so in Sofamore Danek's custom- and special-order division, where implants are modified based on a physician's specifications. "Typically, in custom and specials surgeries are involved. So, when the physician calls with a particular need, we'll have to respond to that quickly, because he will have a surgery date in mind. If the physician is not here—say we're doing this over the phone—we will FedEx him the part and he will look at it and decide if he wants changes. We'll go through that until he gets what he wants, then we'll actually build the part and send it to the doctor for surgery."

Although rapid prototyping has significantly enhanced Sofamore Danek's production process, the technology does have its limitations, such as the lack of materials options, MacDonald notes. "The plastic that we use gives us the greatest detail on our small parts, but it also breaks very easily. Physi-



Baxter Healthcare engineers created this stereolithographic model of a biopsy needle housing which served as a master for a urethane mold.

icians and sales reps tend to like to flex these things, so the first thing they do is try to see how far they'll bend, and they often break. Fortunately, we can just glue the pieces back together." Another problem is that the prototypes can't be brought into the operating rooms for the surgeons to judge size and placement, because the piece would first have to be sterilized which would melt the plastic. Although Stratasys has introduced a newer, more malleable plastic that can withstand increased manipulation as well as sterilization, MacDonald says it doesn't provide enough detail in the models.

As noted, concept development is just one area in which RP processes are paying off for medical manufacturers. At Baxter Healthcare, a disposable-medical-products company based in Round Lake, Illinois, designers rely on two RP processes: 3D Systems' stereolithography and Cubital America Inc.'s (Troy, MI) solid ground curing to create master models from which they develop metal castings. The masters also serve as a basis for multiple subtooling processes. For example, after a master model has been generated via one of the RP machines, the engineers might build a urethane mold around it, cut open the mold, pull out the master, then inject thermoset material into the mold to make prototype parts.

This process is useful in situations where multiple prototypes are necessary, because the engineers can either reuse the rubber molds or make many molds using the same master. The prototypes are then delivered to customer focus groups and medical conferences for professional feedback. Design changes are then incorporated into the master CAD database (Baxter uses Parametric Technologies' Pro/Engineer CAD software). Once the design is finalized, the master database is used to drive the machining of the part. According to Baxter vice president Mike McEvoy, the process has not only cut development time significantly but it has also practically eliminated the need for physical drawings. "The only time we're using drawings now is when the product is going to market, for quality control and master documentation files."

Baxter has been using computer-driven RP since 1987. Because of the cost associated with rapid prototyping (machines range from \$60,000 to \$470,000), the company set up a service center for its divisions worldwide and also began marketing the RP services externally, selling time to other companies. Since its inception into the design-production process, the technology has been especially helpful in closing the communication gap between the marketing and engineering departments, says McEvoy. "Marketing traditionally has had difficulty interpreting 2D drawings. Now, they've got the physical third dimension—the touch, the look, the packaging—so they can really feel comfortable with a design." In fact, says McEvoy, "Although many people believe that advances on the CAD side will enable all decisions to be made based on electronic models, what we're finding out is that there is still really a great need for the physical model."

Although the advantages to incorporating RP into the production process are obvious, McEvoy warns that the decision to do so should not be made lightly. "Where most companies go wrong is in underestimating the commitment that has to be made to support and maintain these systems effectively." For example, he says, "You have to educate and train people differently to work with these systems over conventional fabrication tools, because there are so many features and parameters [such as layer thickness, orientation, time between layers] that have to be monitored."

RP Options

Because of the major commitment involved in implementing a successful RP system in house, and because the machines require a fairly large volume of activity to support their steep cost, companies often decide it's more convenient and cost-effective to rely on a service bureau for rapid prototyping. Another reason companies look toward service bureaus is to avail themselves of the advantages provided by various RP processes, rather than limiting themselves to one technology.

For example, says Frost Prioleau, president of Plynetics, a San Leandro, California-based service bureau that offers a variety of RP capabilities as well as conventional milling processes, certain applications may be better-suited to one RP process than another. "If someone is looking for a part for a design review or a part that's going to be a master for secondary tooling applications, we typically will use stereolithography, because it gives very good detail and accuracy." On the other hand, he notes, "if they're looking for a part to be used in more functional applications, where they may need to run it through an autoclave for steriliza-

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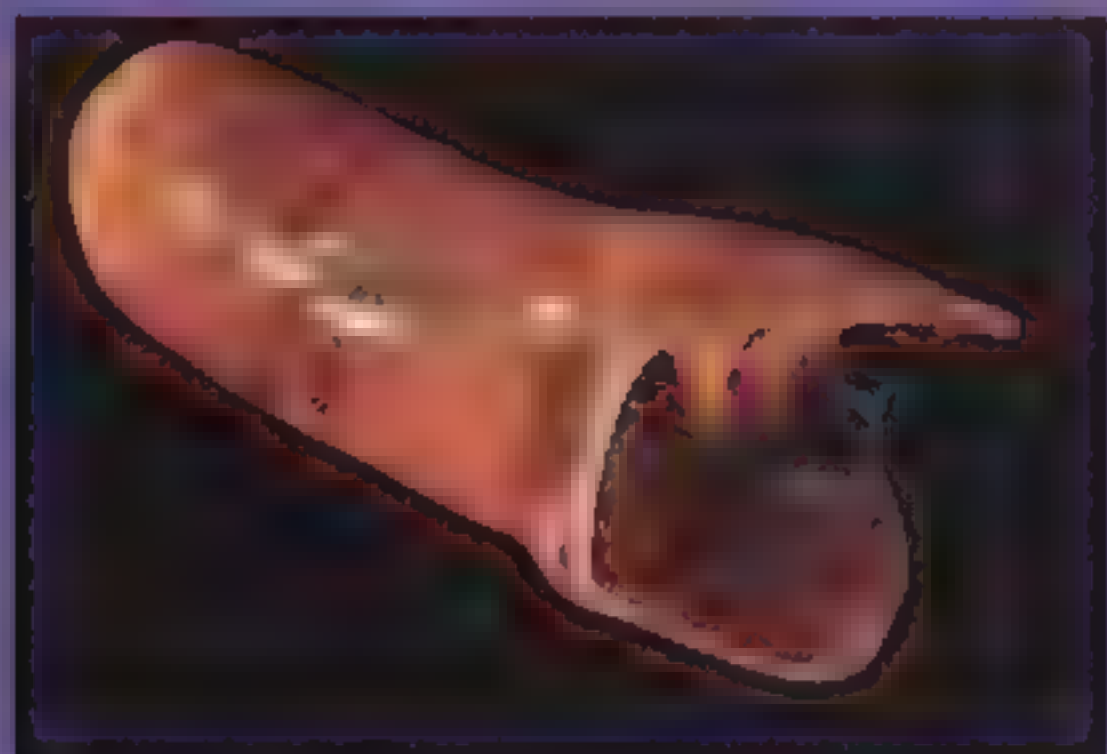
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To develop a custom prosthetic, Baxter Healthcare engineers created a stereolithographic model from laser-scan data of a lower extremity

tion, or they need tougher mechanical properties, then often we'll use selective laser sintering [see "A Quick Look at RP Technologies," page 48] with the nylon material, which is one of the tougher RP materials available." If a customer needs parts in particular materials that RP machines don't process, CNC machines might be used.

For some medical applications, however, CNC is not an option. The nature and complexity of certain models demand the use of rapid prototyping. "If, for example, you had to try to machine a skull model from scan data, it would be virtually impossible," says Al DeWitt, managing partner of Laserform Inc., an Auburn Hills, Michigan-based RP service bureau and US distributor of Materialise's software. "First off, the skull is a closed object, so you couldn't reach in and remove the support structure. And suppose you wanted to go in and machine an eye socket; you're coming down from the top where there isn't an opening." Creating closed cavities such as this is an area in which RP shines, because it is an additive process rather than a subtractive one. Additionally, rapid prototyping and digital models

◀ This stereolithographic model of a bone tumor earned a Belgian company called Materialise the 1993 European Stereolithography Users Excellence Award. A surgeon used the model to plan a complex procedure.

generated via medical scans are complementary, in that both rely on layering 2D cross sections.

Despite the seemingly good match between rapid prototyping and medical scanning, the use of RP to create anatomical models from CT and/or MRI data has yet to really take hold in the US. "It's much more popular in Europe and in Japan," notes Plynetics' Prioleau. "One of the reasons, I think is that no one's figured out who's going to pay for it. Insurance companies don't yet have a line item where they'll pay for an RP part as part of a medical bill." This is unfortunate, he says, considering the obvious financial advantages. "If you look at, say, brain surgery, and what it costs for every hour the patient is on the table, if [using RP models] can eliminate an hour or so of operating time, or eliminate the need for second operations after initial exploratory procedures, then it becomes very beneficial to be able to make a prototype of the patient's bone structure prior to surgery."

In addition to this conceptual roadblock, there are some technical challenges to the use of RP for creating anatomical models, a major one being the lack of a standard format in the medical scanning industry for providing scanned layers of data. According to Laserform's DeWitt, "From our end of it, and from the software developer's end of it, the challenge is in unraveling a nonstandard system for taking different companies' scan data and putting it into something that makes a useful model. There would definitely be value in having an industry-wide format for data processing, but the companies' systems are proprietary, and the industry is very competitive."

Despite the obstacles, software developers are aware of the value of generating models from actual pa-

tient data and are working to incorporate these capabilities into their products. Materialise has done so with its CT-Modeller software, which translates medical-image data into a format suitable for stereolithography. This software provides a direct interface between CT data and 3D Systems' stereolithography machine, as opposed to generating an .STL file. According to Bart Swaelens of Materialise, CT-based stereolithography models are useful for planning complex surgery. Additionally, having an accurate 3D model of the existing structure eases the design of prostheses. "The model can serve as a negative from which the implant is generated manually prior to surgery, or it can serve directly as a master for the implant. Mirror images could be used to reconstruct the face or breast, for example, to achieve symmetry," he says.

Another approach is embodied in a software program called Surgicad Design from Intergraph (Huntsville, AL). Surgicad translates raster-graphic data from CT scans into an equivalent vector-graphic database that can be imported into the Intergraph EMS modeling system. Once in EMS, a solid model can be generated and translated into an .STL file for rapid prototyping. According to one of Surgicad's developers, Dr. David Crook, president of a stereolithography service bureau in Dallas called 3C Design Corp., "This technology could provide a very active cost-containment tool for the medical-implant industry, in that it would ultimately allow for a zero-inventory situation. Companies wouldn't have to carry inventory of standard hips and knees, because each device would be made-to-order. Also, not having to modify standard parts translates into faster implant time." More importantly, because the implants are patient-specific, healing is acceler-



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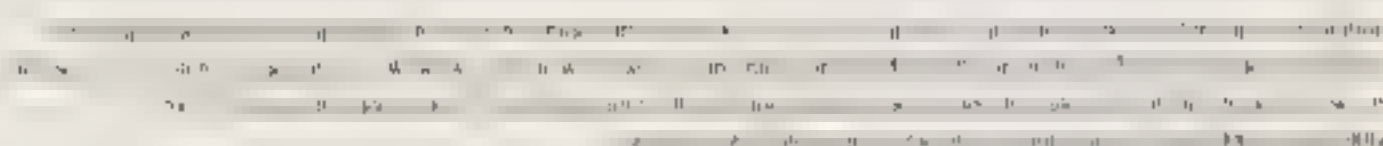
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CIRCLE 22 ON INFORMATION CARD



Engineers at DePuy Inc. created a CAD model of a knee implant using the company's Intergraph system. From the CAD data they generated a stereolithographic model.

ated and pain resulting from mismatched implants is less of a risk," he notes.

Engineers at DePuy Inc., a supplier of orthopaedic implants based in Warsaw, Indiana, have integrated Surgicad into their design environment, using it to analyze the potential fit of implants in a specific patient and then modifying the implant design appropriately. The Surgicad model can be imported into the company's Intergraph system to create an .STL file. According to Dan Anderson, design concept manager at DePuy, stereolithography plays a major role in the production process of all the company's products, standard and custom. "We have two

[3D Systems] SLA machines, which we use for creating everything from show-and-tell-type parts to prototypes for knee simulators to check a knee design," he says. The company also uses the prototypes as masters for casting patterns to launch a product or to do clinical releases of a product. For this application, there are three advantages to using this method over traditional casting tooling, he says. "First of all, you don't have your typical 10-week lead

time. Second, you're not spending \$8000 to \$10,000 on the part. Third, if there are any changes, you don't have people saying, 'We just waited 10 weeks and spent \$10,000 on this and now you want to change it.'"

DePuy does use conventional machining for some applications such as when the model is going to be taken into the operating room. "You can't take a [stereolithographic model] into the operating room, because there's no validation of whether it's inert or not," says Anderson. Also, when the engineers don't have a solid model to work with, it can be faster to bypass the RP route, he says. "Ten percent of the time, we decide we don't want to mess with a CAD model. We have

some decent ideas and sketches and we just bring them right back to the shop and build the part."

Still a young technology, computer-driven RP is constantly evolving. Already, according to Baxter's Mike McEvoy, "the focus is shifting from prototyping to rapid manufacture and rapid tooling. In the last couple of years, the techniques and processes to generate manufacturable tools have come a long way."

Undoubtedly, medical applications will benefit from the technological enhancements that loom on the RP horizon, such as the ability to generate prototypes directly in metal as well as in biocompatible materials, and the ability to create models of soft-tissue structures directly from scan data.

With respect to design applications, says McEvoy, "I've no doubt that pretty soon, rapid prototyping is going to become the standard by which all product development in this industry is achieved." And, in terms of its use as a surgical planning and educational tool, Laserform's Al DeWitt is confident that it will become more widespread in this country. "I think it will become so obviously useful, and the cost savings will become so significant, that somebody will pay for it. It's too valuable not to be used." **C&W**

A Quick Look at RP Technologies

Although some rapid-prototyping (RP) processes are better-known than others, there are a variety of technologies available to build physical models based on digital data. For example, stereolithography, which was invented in 1986 by 3D Systems (Valencia, CA), involves the use of photosensitive liquid polymers to fabricate models of CAD designs. Basically, a UV laser traces a thin cross section of an object onto the surface of a vat of liquid photopolymer, selectively hardening the photopolymer. An elevator then drops the forming part, recoating the top surface in preparation for the next cross section. The process is repeated until the 3D part is built. Because the photopolymer can deform as it cures, physical supports have to be incorporated into the model's fabrication. These are removed after final curing.

A process called solid ground curing, which is the basis of the Solider series of RP machines by Cubita America Inc. (Troy, MI), involves another chain of

events. Models are built layer by layer from a liquid plastic resin that solidifies when exposed to UV light. After the model hardens, all unsolidified resin is collected, and wax support material is spread into the remaining cavities. Unlike stereolithography, however, solid ground curing is self-supporting because the wax automatically provides continuous structural support.

Selective laser sintering, the process developed by DTM Corporation (Austin, TX), begins by depositing a thin layer of heat-fusible powder into a workspace container and then heating it to just below its melting point. An initial cross section of the object under fabrication is traced on the powder surface by a laser. The laser raises the temperature of the powder to the point of sintering, forming a solid mass. Each layer is sintered to such a depth that it is fused to an underlying layer. Successive layers of powder are then deposited and sintered until the object is completely fabricated. In areas not sintered, powder remains loose and serves

as a natural support.

Another popular process is that developed by Stratasys Inc. (Eden Prairie, MN), called fused deposition modeling, through which thermoplastic filament material is delivered layer by layer through a heated extrusion head. This process is ideal for small parts and organic shapes.

In the RP machines from Helisys Inc. (Torrance, CA), the modeling technology is called laminated object manufacturing. With this technology, flat sheets of laminated paper are laser-cut one sheet at a time. The machines stack the cut silhouettes on top of one another to build the geometry. The finished models have the appearance and texture of wood and, thus, are very amenable to casting.

Depending on the technology and on the intended application of the prototype part, most RP models require some post processing, such as sanding or bead blasting, to achieve a smooth finish. —DPM

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PC Magazine

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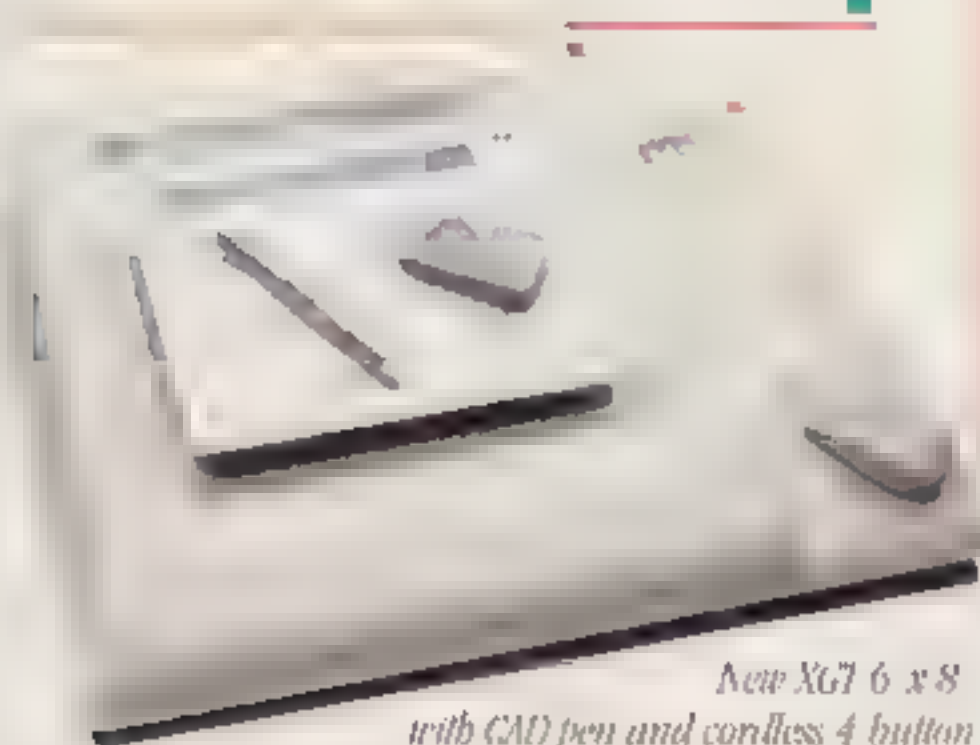
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HOTTEST PRODUCTS OF

Editors' Choice Awards

Welcome to our first annual CGW Editors' Choice Awards. For the first time, we've decided to sit down, look over the past year's worth of new product introductions, and offer formal recognition to those products we felt were some of the most innovative and/or significant products to hit the market in 1994.

Only new products were eligible for an award, and to qualify for consideration, products had to begin shipping sometime between January 1, 1994 and December 31, 1994. In judging, we looked for products that we felt brought innovative new features to the market and/or set significant new price/performance benchmarks. The primary purpose of the awards is to recognize innovation. However, the significance of a product's market impact was also considered and at times proved to be a deciding factor.

As you might imagine, selecting the award winners wasn't easy, as 1994 saw the introduction of lots of exciting products. Our judging criteria was subjective in nature, and it's certainly possible to argue that there are other products equally deserving. But in making the decisions, we consulted an advisory panel of industry experts and spent a good bit of time debating amongst ourselves. In the end, we offer you a list of 30 award winners and 30 more honorable mentions that we think demonstrate a degree of innovation and significance that deserves special recognition. These were truly some of the hottest products introduced in 1994, and they are the kinds of products that are helping move computer graphics technology forward.—Editor



VIRTUAL REALITY

FIRST PLACE

Division's ProVision 100 VPX

Division brought a new level of realism to the VR marketplace this year when it added the VPX graphics accelerator board to its ProVision 100 virtual reality system. The board, which is based on the massive parallelism of the Pixel-Planes architecture developed at the University of North Carolina, can display 160 million fully photo-textured pixels per second and offers simultaneous Gouraud shading, texturing, and specular lighting. (Division Inc., Redwood City, CA).

"Division is one of the few VR companies that has demonstrated technology that shows promise for real industrial applications."—Terry Wohlers



RUNNERS UP

Virtual Research's VR4

This lightweight, head-mount display from Virtual Research Systems sets the standard in the market for high-quality VR display devices. It features an ergonomic design, a separate control box, and a resolution of 742x230 per eye. (Virtual Research Systems, Santa Clara, CA)

Paradigm's Vega 1.0

The release of this new SGI-based software product from Paradigm Simulation offers an easy-to-use environment for building virtual reality applications. Designed to be usable by non-programmers, this software helps make VR technology more accessible to a wider range of users. (Paradigm Simulation, Dallas, TX).

1994

EDITORS' CHOICE AWARD

COMPUTER GRAPHICS WORLD

MODELING/ANIMATION SOFTWARE

FIRST PLACE

Autodesk's 3D Studio Release 4

Autodesk enhanced its dominance of the PC-based modeling and animation market with this strong new release of its popular 3D Studio software. Among the many new features in this latest upgrade were true 3D inverse kinematics, fast preview rendering, a keyframe scripting language, and perspective matching. (Autodesk, Sausalito, CA)

3D Studio is a clear price/performance leader that has kept its innovative edge.—Jon Leland

RUNNERS UP

Cambridge Animation's Modular Animo

This PC-based 2D animation software is an impressive tool that meets the needs of professional animators. While allowing cartoonists to draw in a traditional manner, the software automates many of the most labor-intensive tasks—scanning, ink-and-paint, compositing, scene layout, camera movements, and previewing. (Cambridge Animation Systems, Cambridge, England)

Hash's Animation Master V.1.0

When it comes to character animation, few packages on the Mac or PC can match the power of this program. Among the tools it offers are spline-based modeling, inverse kinematics, skinning between hierarchical segments, patch-based mapping, and lipsynch keyframing. All for a low price. (Hash Inc., Vancouver, WA)



HONORABLE MENTIONS

VIRTUAL REALITY

- Sense8's World Toolkit for Windows
- Virtual I/O head-mount display
- Kaiser-Electro Optics' VIM head-mount display

MODELING ANIMATION SOFTWARE

- Wavefront Kinemation V 2.0
- Caligari's trueSpace V1.0
- Electric Image Animation System Rel. 2.0
- Eos System's PhotoModeler

RENDERING AND SPECIAL EFFECTS

- 5D Solution's TMorph3 morphing software
- Adobe's (CoSA) After Effects 2.0
- Wavefront Composer 3.0

CAD/CAM SOFTWARE

- Autodesk's AutoCAD Rel. 13
- Rasna Mechanica Rel. 6.0
- Sigma Design's Arris Integra

GRAPHICS INPUT

- Polhemus 3Draw
- Faro Technologies' Space Arm 3D digitizer
- Schrieber Instrument's Imagine Puppeteer

VIDEO, MULTIMEDIA

- Macromedia Director 4.0

GRAPHICS OUTPUT

- RasterGraphics' Digital ColorStation 5400i
- Stratasys' FDM rapid prototyping system
- Tektronix Phaser 540 color laser printer

PAINTING ILLUSTRATION, IMAGE EDITING

- Alias StudioPaint 1.0
- HSC LivePicture
- Amazon 3D Paint

VIDEO AND GRAPHICS BOARDS

- Alpha System Lab's megaMotion 1.0.6
- Intel's Smart Video Recorder
- Truevision's Targa 2000

GRAPHICS DISPLAYS

- Mitsubishi Diamond Pro 29 monitor
- Nanao Flexscan F780i monitor
- Seiko Epson ELP-3000 LCD projector
- Proxima Ovation 920 LCD projection panel

RENDERING AND SPECIAL EFFECTS

Elastic Reality



This multi-platform tool is hailed by many as not only the best morphing package on the market but an invaluable special effects software program as well. In addition to a range of new enhancements, this package in 1994 dramatically lowered its price and moved onto the Windows platform. (Elastic Reality Inc., Madison, WI)

"Elastic Reality not only allows you to create great morphing sequences, but it's also a very useful everyday tool for creating moving mattes."—Rhonda Olson



RUNNERS UP

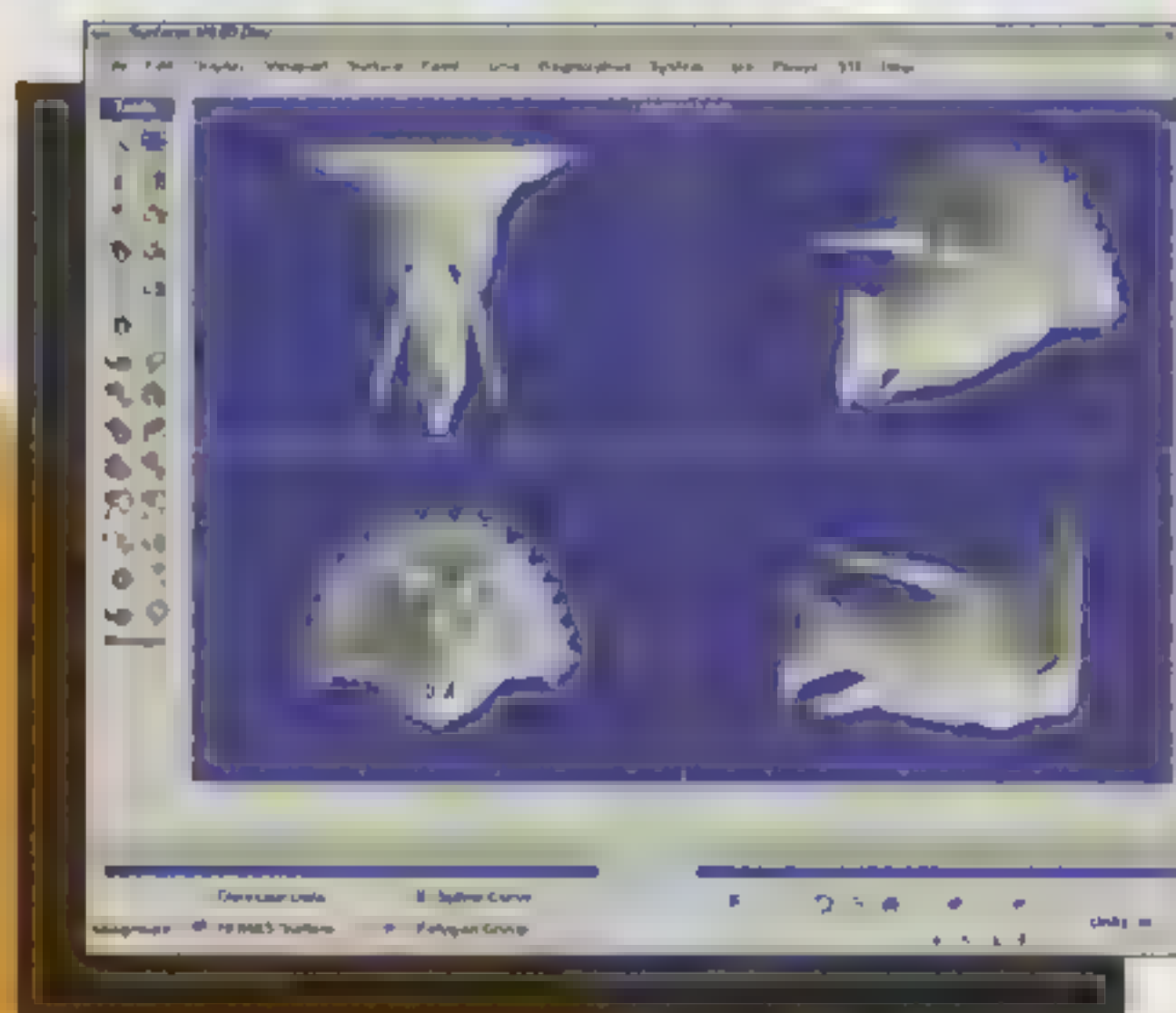
Lightscape Visualization System

The Lightscape Visualization System hit the market this year boasting to be the first computer graphics application to combine radiosity algorithms with a physically-based lighting interface, making it an innovative new design visualization tool for simulating and analyzing lighting conditions in complex spaces. (Lightscape Technologies Inc., San Jose, CA)

Xaos Pennello

1994 saw the introduction of a good number of innovative new plug-in products for 3D Studio. Of those, one of the most fascinating was Pennello from Xaos, which brought animatable brushes and stunning, painterly special effects to the PC that previously were unavailable. (Xaos Tools, San Francisco, CA)

CAD/CAM SOFTWARE



Parametric Technology Release 14

Parametric Technology continues to turn the CAD/CAM world on its head as the demand for its product continues to skyrocket. With Release 14, the company introduced three new application-specific modules and 700 enhancements, a clear testament to the company's ability to respond quickly to customer demands. (Parametric Technology Corp., Waltham, MA)

FIRST PLACE

Imageware Surfacr Version 4.0



With over 120 enhancements in point processing, curve creation and editing, and surface fitting, editing and display, Surfacr Version 4.0 goes a long way to improving the value of 3D digitizing as a reverse engineering tool for CAD/CAM applications. It fills a need that no other product does. (Imageware Inc., Ann Arbor, MI)

"Surfacr bridges the gap between 3D digitized data and most graphics and CAD/CAM programs."—Terry Wohlers

AutoCAD Designer Release 1.0

Though criticized by some as being a product with flaws, there's no question Autodesk heated up the market with this innovative attempt to bring parametric, feature-based 3D CAD software to the PC. Other vendors are already rushing competing products to market, and Autodesk itself has just announced Release 1.1, with new features that promise to make the product more productive. (Autodesk, Sausalito, CA)

GRAPHICS INPUT

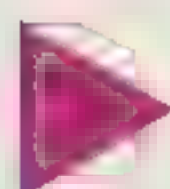
FIRST PLACE

Apple's QuickTake 100



This critically-acclaimed digital camera has won wide praise for making digital color image capture available to the mainstream. This lightweight, attractively designed product makes it easy to bring photographic images into Macintosh and Windows computers without film development or scanning. The price? Just \$729. (Apple Computer, Cupertino, CA)

"The QuickTake is the first shot in the digital photography revolution." Frank Romano



RUNNERS UP

Digital Image Design's Monkey

An innovative step forward in motion-capture technology. This 6x6x18-inch armature is designed in the form of a human figure and has measurement devices at all important joints. Place this "digital doll" on the desktop next to your computer and you can control an onscreen animated figure. (Digital Image Design, New York, NY)

Cyberware's Zipper

The problem of scanning large, complex objects got a little easier with the introduction of Zipper software from Cyberware. Such objects often require multiple cylindrical and linear scans, and with Zipper software, those scans can now be easily "zippered" together into one continuous mesh. (Cyberware, Monterey, CA)

VIDEO/MULTIMEDIA

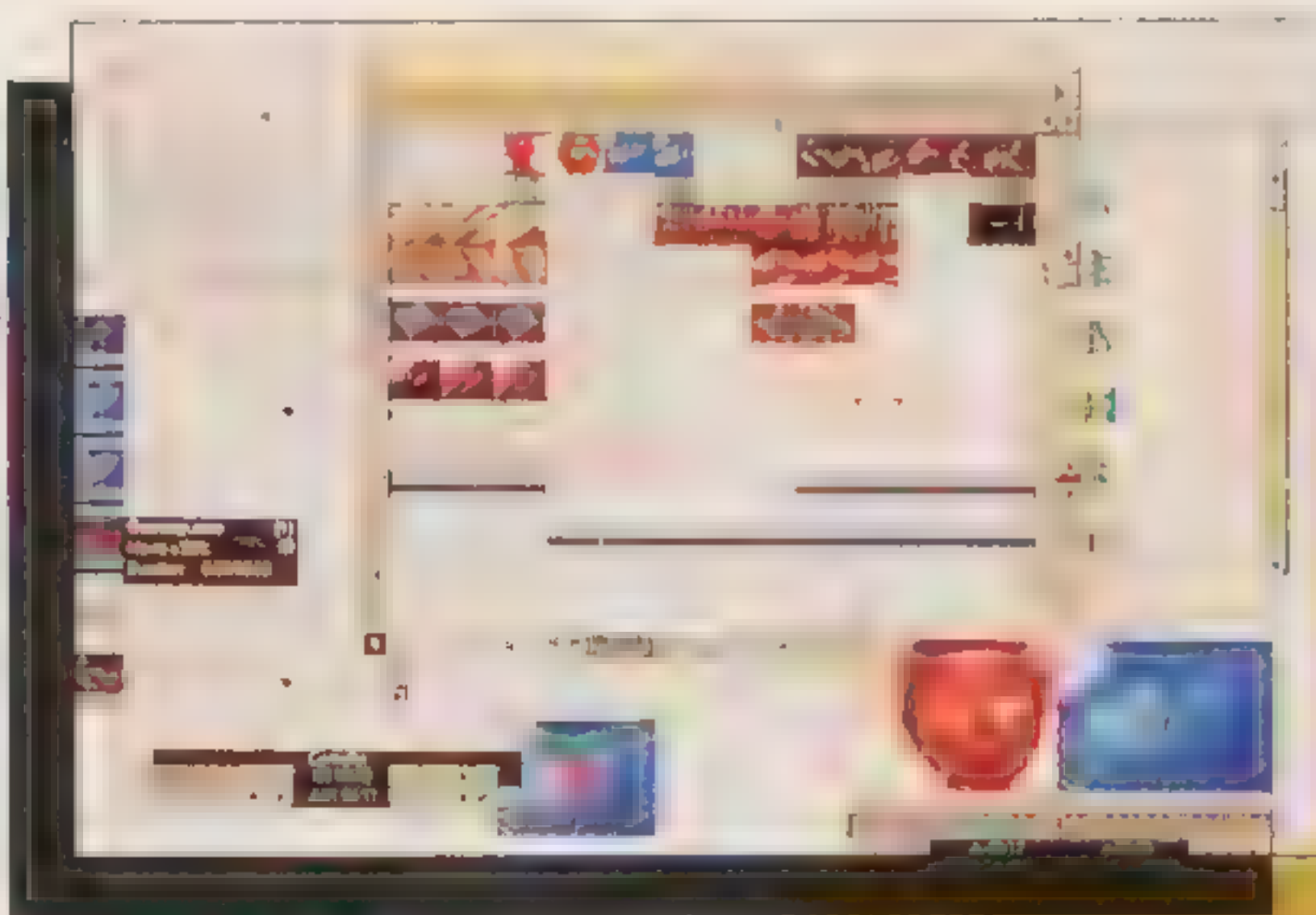
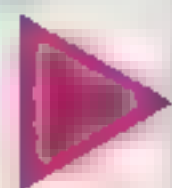
FIRST PLACE

Adobe Premiere 4.0



With the release of Premiere 4.0, Adobe once again advances the state-of-the-art of affordable, desktop video editing. And happily for PC users, with this release, the PC-version of Premiere now rivals its Mac counterpart in power. New features include a trimming window, auto insert edits, improved ripple and rolling edits, improved motion control, EDL enhancements, and dynamic previewing. (Adobe Systems, Mountain View, CA)

"Premiere opens new creative avenues for users of desktop PCs by providing professional editing capabilities that are uniform across multiple platforms." Ken Milburn



RUNNERS UP

Data Translation's Media 100 2.0

This year Data Translation did an admirable job of beefing up this Mac-based video editing tool, while also cutting the price of the base system by \$3000. Version 2.0 features "all-on-one-mastering", a characteristic that enables both high-capacity, draft-mode editing and high-quality online mastering with one system. Other new features include QuickTime codec, auto (batch) digitizing, trim mode, and dual subsampler. (Data Translation, Marlboro, MA)

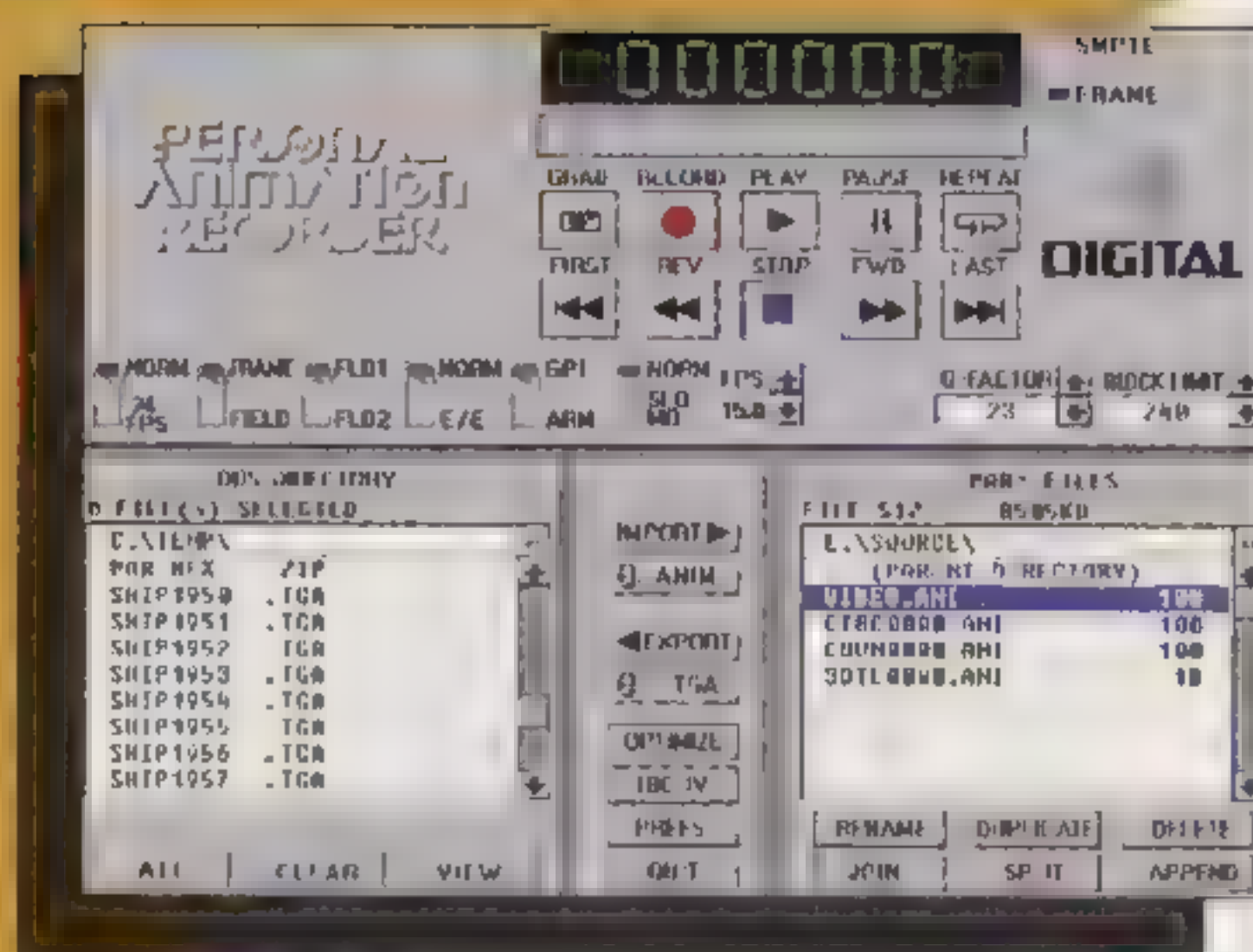
Avid's Media Suite Pro 3.0

Impressive improvements were likewise made on Avid's mid-level, Mac-based digital-video editing suite. New features include QuickTime codec, an enhanced image quality option (\$4000) that reportedly rivals Belacam or even BetaSP, timeline editing, expanded and improved audio-editing capabilities, more transitions and effects, and in-package support for plug-in effects from Photoshop and VideoShop. (Avid Technology, Tewksbury, MA)

ADVISORY PANEL

Although all final award decisions were made by the CGW staff editors, we did assemble an advisory panel of industry experts to provide us with guidance. Each of the following people took the time to respond to a ballot that listed a large number of nominees in each category. The votes were tallied and taken into account by the editors during the final decision-making process. We thank the panel for their participation.

- Jim Cavanaugh, Micro Publishing Press
- William Coggeshall, Pacific Media Associates
- D. Scott Dyer, Windlight Studios
- Evan Hirsch, CGW contributing editor
- Kristy Holch, BIS Strategic Decisions
- Jon Leland, Communication Bridges
- Douglas King, CGW contributing editor
- Gregory MacNicol, CGW contributing editor
- Tom McMillan, Computer Artist magazine
- Ken Milburn, freelance computer journalist
- Rhonda Olson, Rhonda Graphics
- Joel Orr, Orr Associates
- Greg Panos, SophisTech Research
- Jon Peddie, Peddie Associates
- Frank Romano, Rochester Institute of Technology
- Alvy Ray Smith, Microsoft
- Sharon Steuer, freelance computer artist
- Terry Wohlers, CGW contributing editor
- L. Stephen Wolfe, Computer-Aided Design Report newsletter



GRAPHICS OUTPUT

FIRST PLACE

DPS Personal Animation Recorder



This innovative computer card from Digital Processing Systems offers a low-cost, effective method of moving animations onto videotape. Developed for the PC, this ISA-bus board replaces both the traditional record VCR and single-frame controller. (Digital Processing Systems, Florence, KY)

"A must-have for any animation studio. It's easy to use and allows animations to be dumped from the hard drive to a consumer VCR in real time."—Douglas King

PAINTING/ILLUSTRATION/IMAGE EDITING

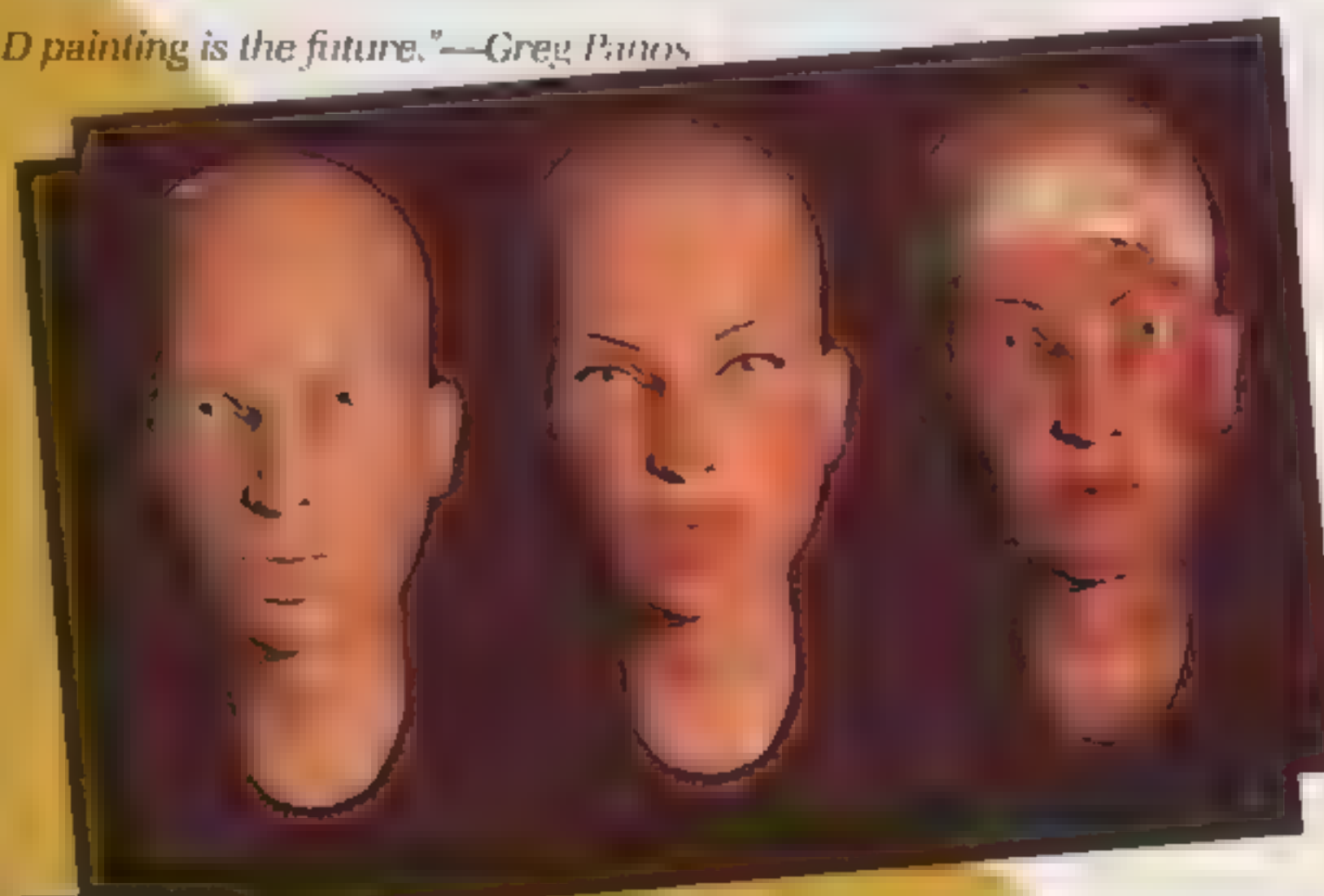
FIRST PLACE

Taarna 3D Paint



Perhaps one of the biggest breakthroughs in computer graphics this year was the arrival of 3D painting software. Leading the charge in that revolution was Discreet Logic's Taarna 3D Paint program, a standalone package for the SGI platform that allows animators and industrial designers to paint directly onto 3D characters and objects. (Discreet Logic, Montreal, Canada)

"3D painting is the future."—Greg Panos



RUNNERS UP

Fujix Pictography 3000

This thermal dye transfer printer produces images with the same quality as conventional photographs with no visible scan lines at speeds that are faster than many dye sub printers. It features 24-bit color, a maximum resolution of 400dpi, and a price tag of \$23,500. This device is well-suited as a final output device for photo retouching as well as for image composition and page layout. (Fuji Photo Film, Elmsford, NY)

Tektronix Phaser 480

Tektronix enhanced its position as the market leader in dye-sub printers with the introduction of the tabloid-sized Phaser 480 printer. The printer offers photo-quality output, fast throughput, and proprietary raster image processing firmware, which allows the printer to be platform-independent. An ideal printing tool for graphic arts and scientific/engineering applications. (Tektronix, Wilsonville, OR)

RUNNERS UP

Adobe Photoshop 3.0

Already considered by many to be an essential tool for any computer graphics user, Photoshop enhanced its position even further this year with this latest release. Available for both the PC and Mac, this version of Photoshop offers a number of significant new features, including support for multiple layers and new color correction tools, both of which add greatly to the artist's flexibility. (Adobe Systems, Mountain View, CA)

Fractal Painter 3.0

This release of Fractal Painter brought to market a range of stunning new special-effects and image-generation capabilities that PC- and Mac-based artists are sure to relish. These features include the innovative Image Hose paint brush, the Gradient Composer, and the Capture Brush tool for creating unique bristle patterns. The package also offers new multimedia and animation capabilities, including the ability to scan through digital video clips and select individual frames for editing. (Fractal Design, Aptos, CA)

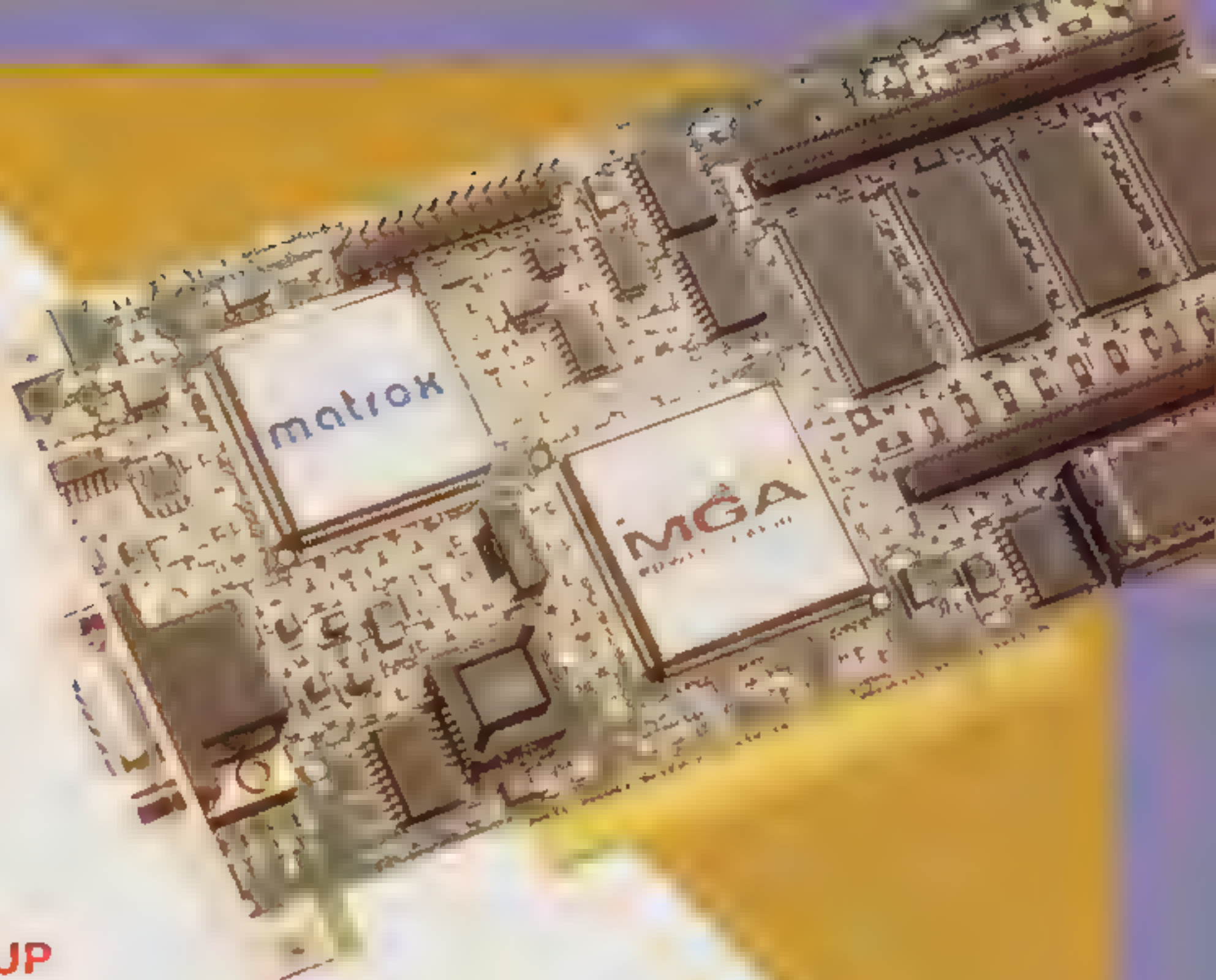
VIDEO & GRAPHICS BOARDS

FIRST PLACE Matrox Impression Plus



Matrox played a leadership role this year in helping the PC become a more viable platform for 3D graphics by being the first to market with an affordable 3D accelerator. The 64-bit Impression Plus, which checks in at the remarkable price of \$450, includes a video upgrade socket for add-on modules. It also supports a range of 3D APIs and boasts some impressive specs, such as the ability to process 150K 3D, shaded, Z-buffered, dithered polygons per second. The board comes bundled with 3D games, 3D demos, and a software developer's kit. (Matrox Graphics, Dorval, Canada)

"This board continues Matrox's leadership in PC-based computer graphics."—Tom McMillan



RUNNERS UP Number Nine's Imagine 128

The first 128-bit board on the market—a PCI-based accelerator based on the company's 128-bit graphics engine. It comes with 4MB of VRAM and an optimized memory controller that handles traffic to and from the processor at sustained bandwidths to 500MB/second. The base board (\$1000) supports resolutions to 1280x1024 at 65,000 colors at 80Hz. The high-end board (\$1499) supports resolutions to 1600x1200 at 65,000 colors at 76Hz. (Number Nine, Lexington, MA)

Fast Electronics'. Movie Machine Pro

Consistently rated as a top performer in reviews, this board offers lots of bang for the buck: PC-based video capture, overlay, output, and playback. It accepts composite video for input/output, and also functions as a two-channel video switcher and TV tuner. Thus, both video and TV inputs can be displayed onscreen and framegrabbed or edited to tape. It also offers such built-in features as a time-base corrector for creating dissolves, wipes, and limited DVEs. The price: \$940. (Fast Electronics, Redwood City, CA)

GRAPHICS DISPLAYS

FIRST PLACE NEC MultiSync XP Series



This new series of monitors from NEC not only offers high-quality graphics for professional users, but it's also the first series of monitors to support the Plug and Play standard and the ACCESS.bus technology, an advanced peripheral connection standard. In addition, the monitors offer On-Screen Manager controls, which provides a user-friendly way of controlling image and color. (NEC Technologies, Wood Dale, IL)

"The early support for Plug and Play shows a real concern for easing user frustration in setting up peripherals."—Stephen Porter

RUNNERS UP Proxima Desktop Projector

Projection technology took a significant step forward in portability and ease of use with the introduction of Proxima's Desktop Projector. Though weighing as little as 18 pounds and standing less than six inches in height, the projector supports a built-in light source, interactivity, advanced ergonomics, and the ability to project up to 2 million colors. (Proxima, San Diego, CA)

Philips' Brilliance 21A

Philips Consumer Electronics brought the Brilliance 21A monitor to market with the claim that it is the world's first digitally architected monitor. Built using Philips' CyberScreen technology, the monitor uses digital correction methods to solve the problem of having inconsistent color and brightness levels across the screen. (Philips Consumer Electronics, Knoxville, TN)

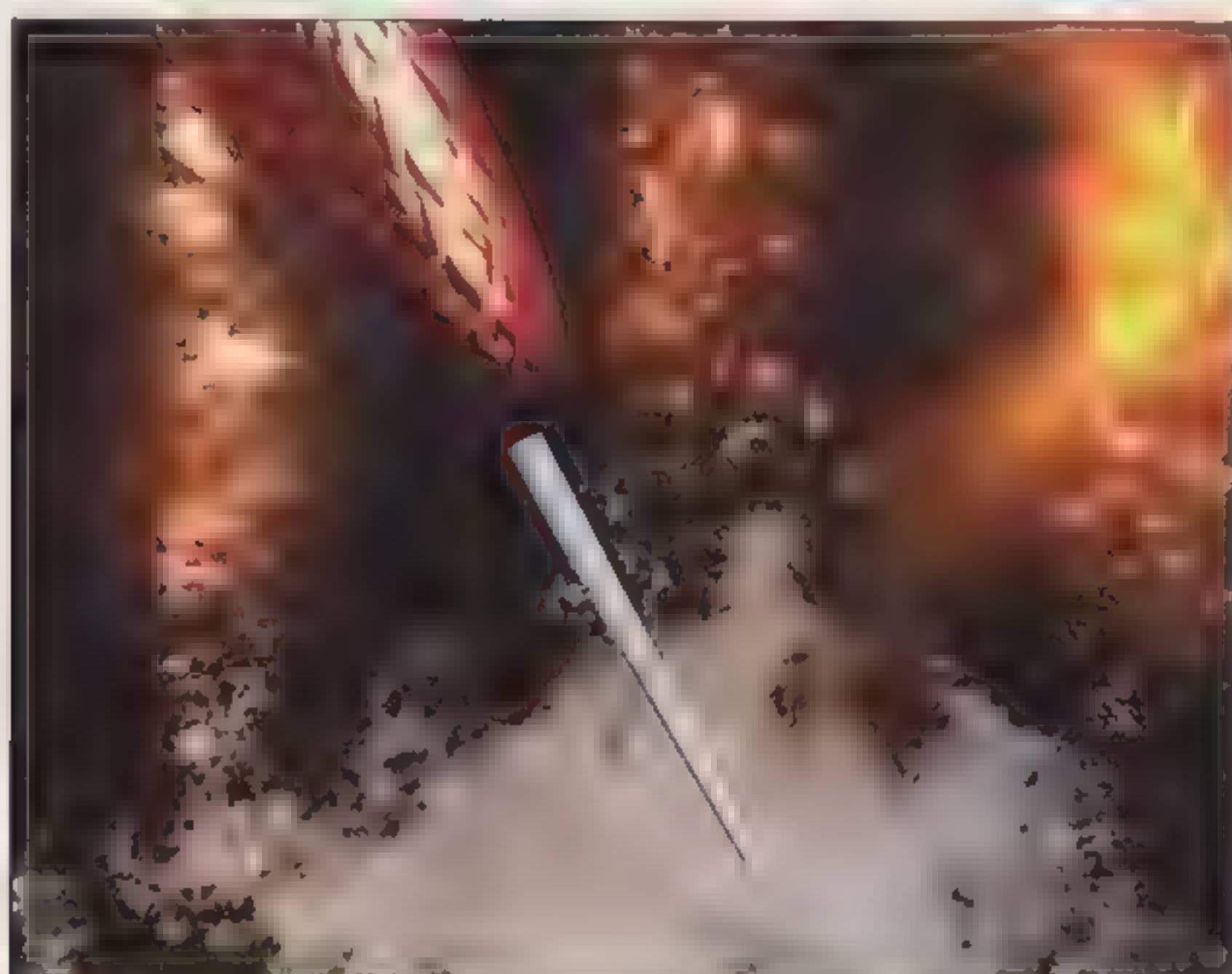


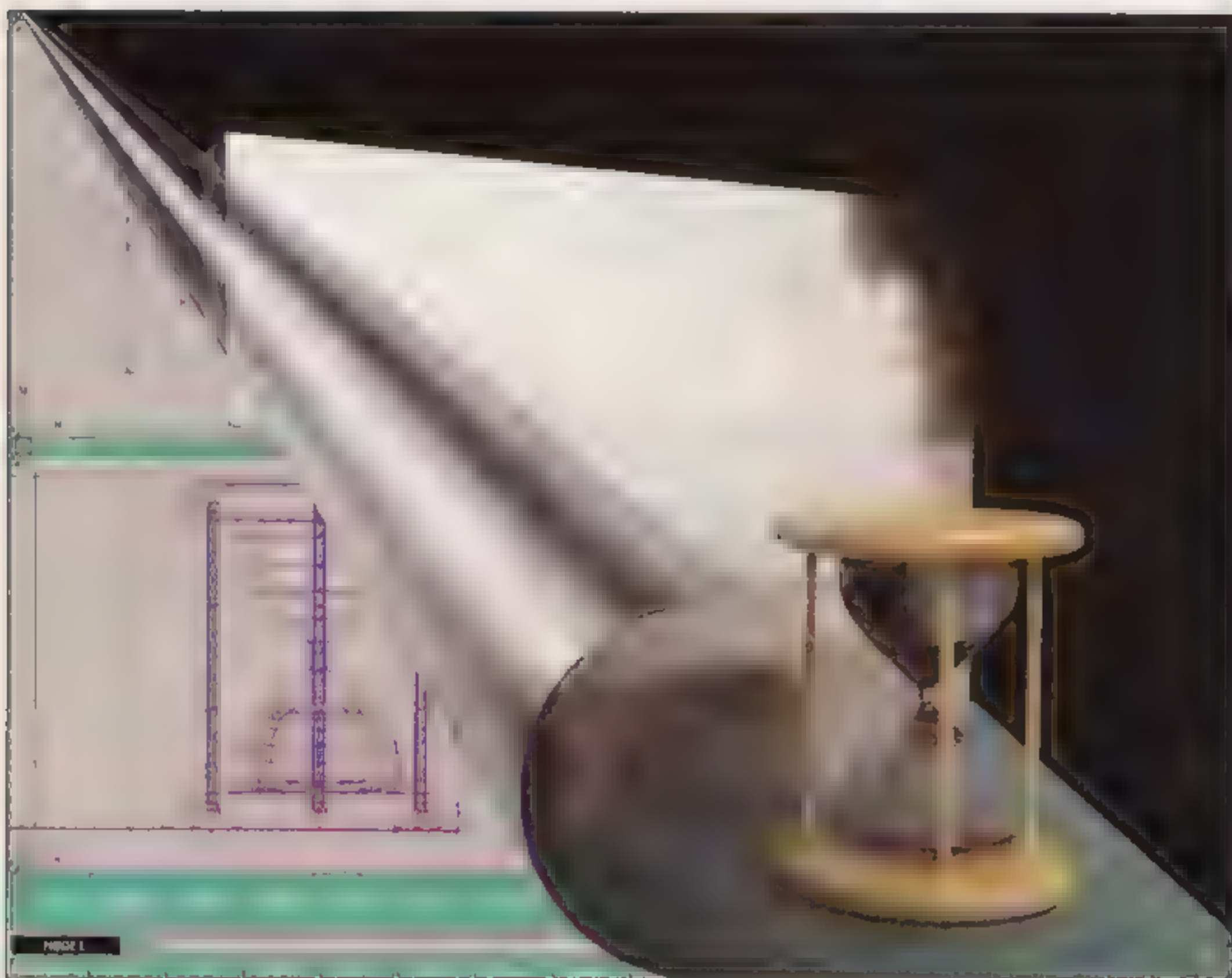
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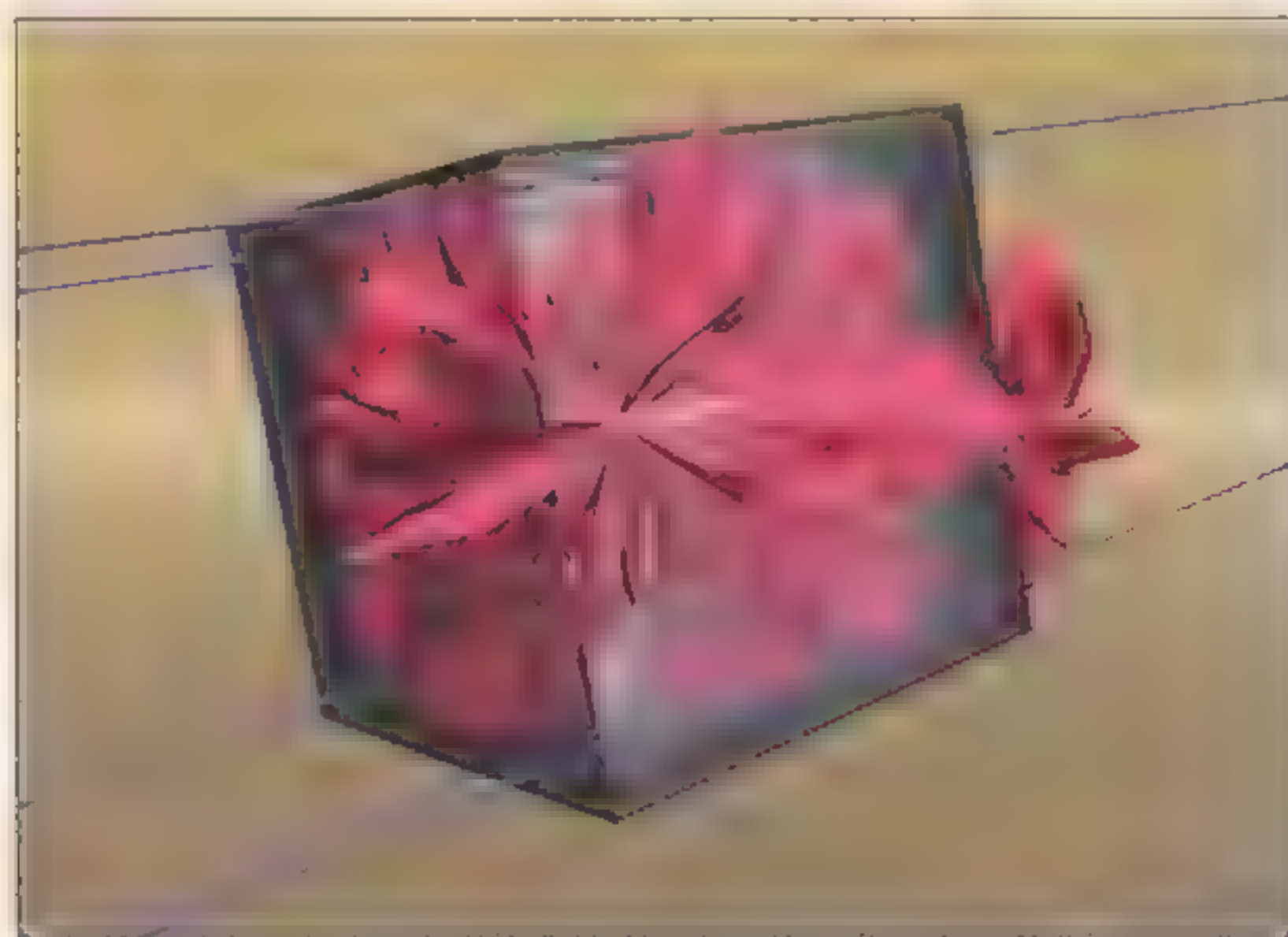
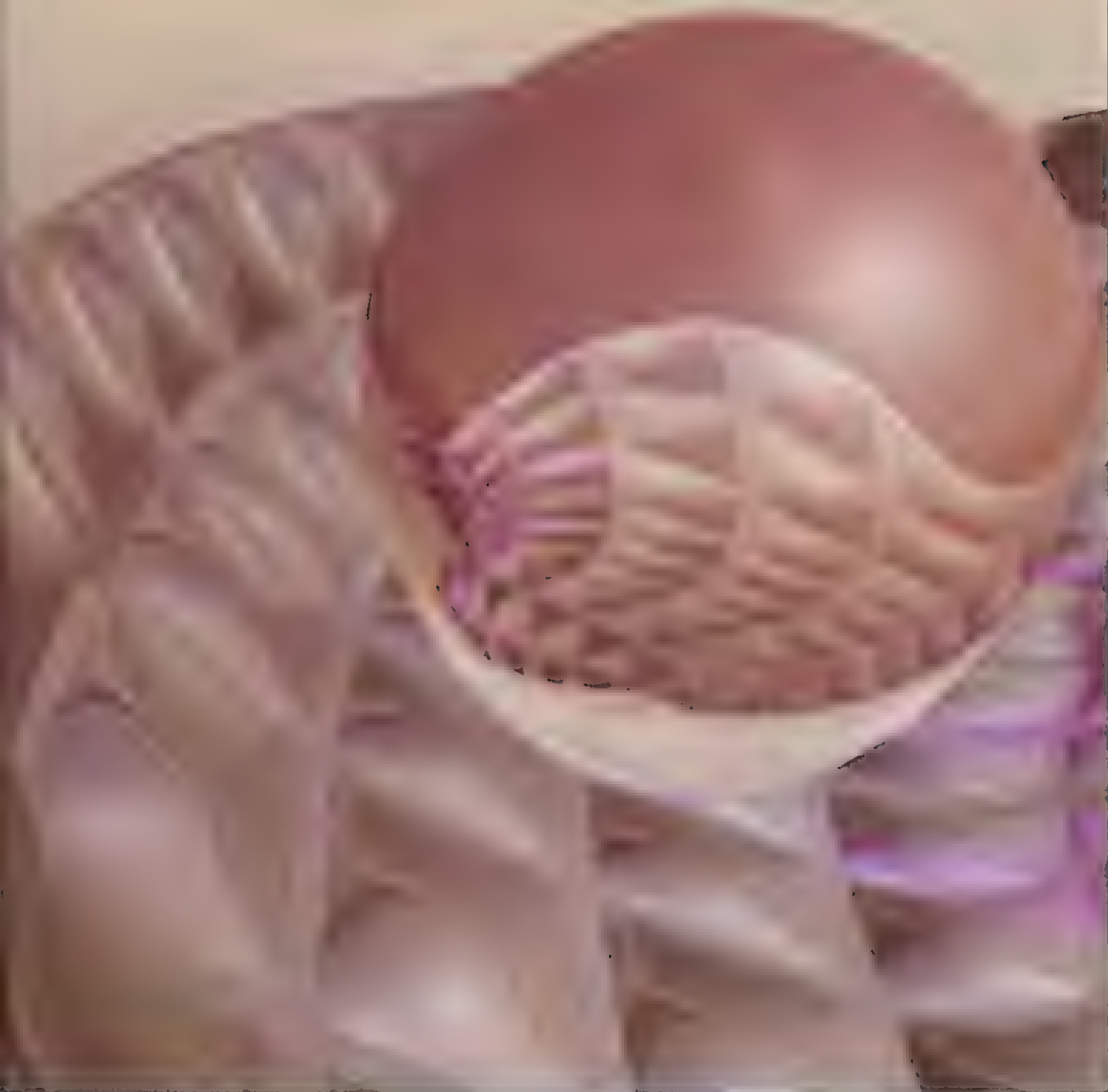
With respect to his commercial work, New York City-based computer artist David Chalk's primary objective "is to make money." For the art he creates in his spare time, such as the images displayed on these pages, "I just want to have fun," he says. The two goals do overlap, in that the money he makes from his professional endeavors finances the tools that allow him to have fun in his personal ones. In turn, the results of his experimentation with textures, light, color, and form inevitably resurface in his commercial projects.

Chalk created the images shown here with Alias PowerAnimator (Toronto) running on a Silicon Graphics Indigo² Extreme. To date, he has focused on the generation of 3D still images for print. Next, he plans on exploring the animation capabilities of PowerAnimator. **C&W**









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A NEW LOOK AT AN OLD STRUCTURE

Research and imagination drive a Toronto architect's computer re-creation of a Spanish castle

The "web of petrified lace" adorning the 14th-century Alhambra castle and citadel in Granada, Spain, is an aesthetic treasure. From a technical perspective, however, the complex geometry of the structure's fanciful style of ornamentation could be

a computer graphicist's nightmare. This is because the honeycomb form embellishing much of the structure comprises numerous curves and prisms, each characterized by subtle changes in size, shape, and color. Despite the challenges these intricacies represent, they were not enough to deter Toronto-based architect Mario Spataru from attempting a computer re-creation of the structure.

Before he began, however, Spataru had to do one thing: learn the modeling program he would be using. To this end, he took a course offered by the Information Design Technology Center at the University of Toronto's School of Architecture, where he learned the basics of Alias Studio. Using the school's equipment, he began the painstaking process of rebuilding the former palace of the Moorish kings. After completing the course at the University, Spataru was able to continue his project using a colleague's equipment—Alias Power Animator running on on a Silicon Graphics Indigo workstation. Although the move from Alias Studio to Alias Animator was one of necessity rather than choice, Spataru felt he got the best of two worlds. "I was lucky to have started in Studio because it gave me the opportunity to model properly. Animator is not as sophisticated for modeling, but it was perfect for rendering."

Beyond the software learning curve, one of the fundamental challenges facing Spataru was that he had none of the actual structural data of the Alhambra to work with, nor had he visited the site (with the exception of a trip he had made there during a vacation 10 years ago). Instead, he had to rely on postcards, hand-drawings, and, he says, "my imagination." He calls his computer re-cre-

To realistically re-create the "web of petrified lace" that adorns the Alhambra, while staying within the limits of his workstation's computing capacity, architect Mario Spataru interspersed 2D maps with 3D models and experimented with various raytracing parameters.

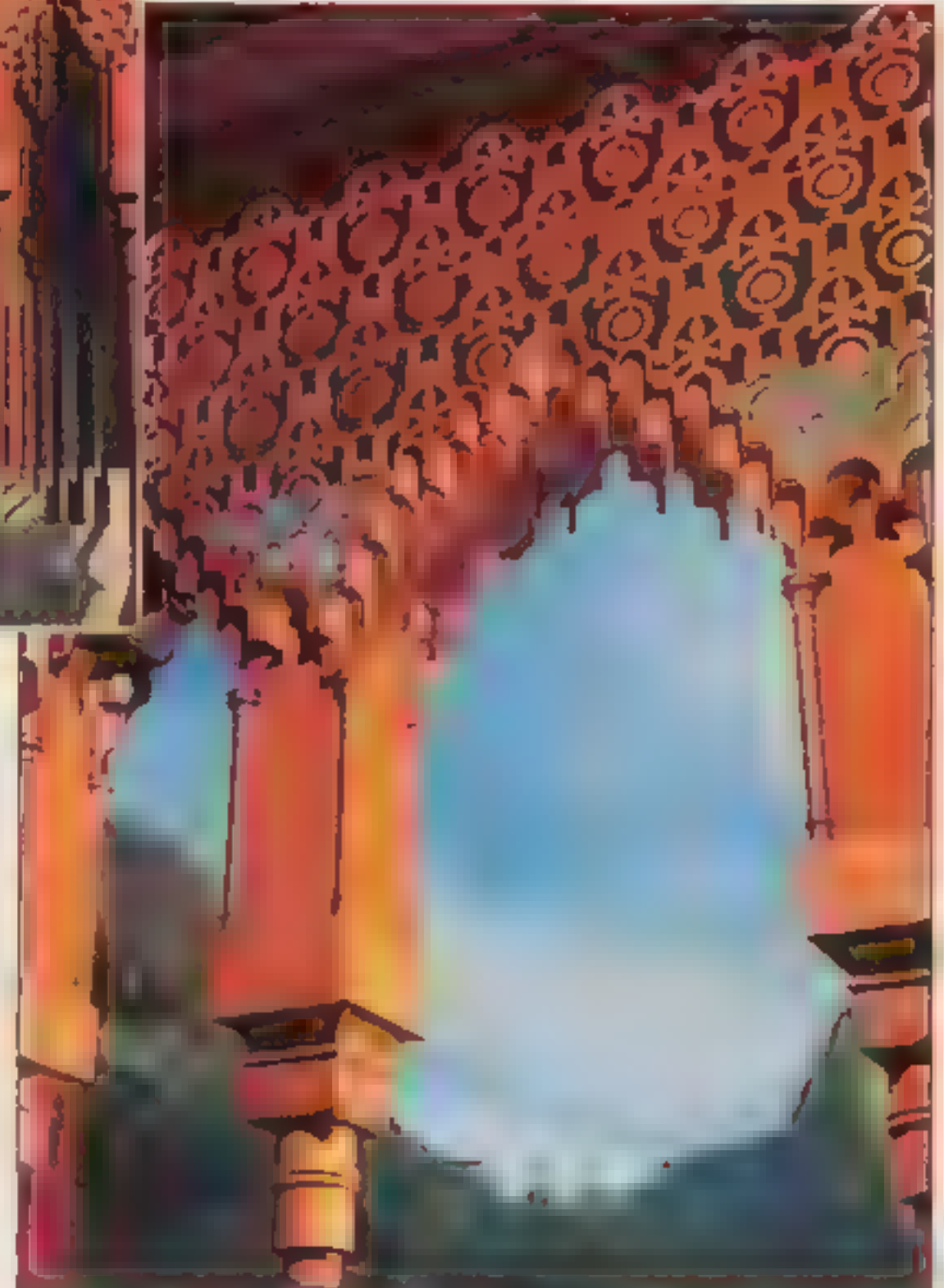
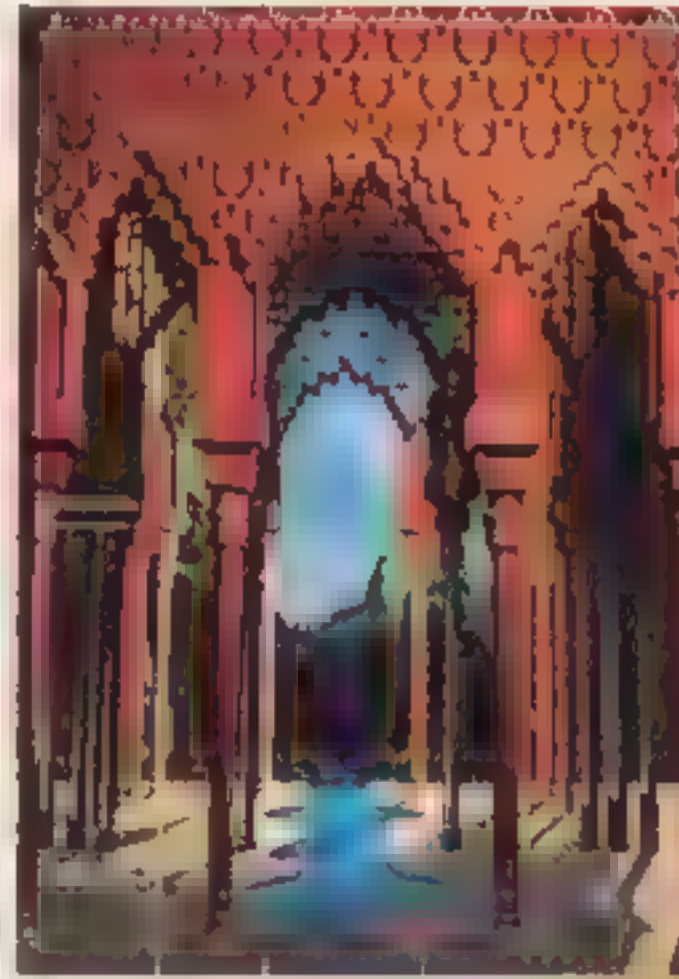
ation of the structure "My Alhambra," because "it is a stylized model of the real [castle], based on my understanding as a professional and my subconscious filtrations." His objective was to capture the beauty of the castle, viewed in its most interesting light and environment. He notes that the structure in the final image, which opens to surrounding mountains, does not represent a realistic layout. "It is a reunification with nature, which the builders of the 14th century wouldn't even have thought of because of security reasons," he says.

In addition to figuring out the relevant geometry based on the limited background material he had, one of the major challenges Spataru faced "was the amount of information I had to move around and eventually render," he says. Part of the magic of the structure, he notes, "exists in the repetition of the decorative elements over and over, sometimes with subtle changes in size, shape, or color."

Unfortunately reproducing all of the structure's subtleties would require files too large for Spataru's computer capacity—32mb of

RAM and nearly 500mb of swap space—to handle. Using every file-reduction trick he could think of—such as using 2D maps rather than 3D models for some elements and low raytrace parameters—Spataru was still able to fully model only half of one of the complex arches. That model alone comprised more than 2400 surfaces. "When I got caught between the aesthetic requirement of repeating a very interesting, but heavy [design] and my computer limitations," he explains, "I used transparent maps." For example, to duplicate the Court of Lions, in which three rows of columns support the decorative archway, Spataru modeled the elements in the first row and simply used 2D texture maps for the second and third rows, integrating shadows and refraction to enhance the realism. The central image of "My Alhambra" took 97 hours to render.

Spataru attributes much of the richness of the resulting image to the careful placement of light sources. "I used six light sources—two ambient, one directional, and three spots—each exclusively linked to dif-



ferent parts of the model to get a variable exposure and to emphasize the cast shadows of the columns and the arches on the terrace and the water surface," he says.

Although the file was large, the capabilities of the Alias software eased Spataru's navigation through it. "I really appreciated the four windows and extra cameras with different perspective views that you can use simultaneously in Alias. Also, the fact that I did not have to use any other software for creating this image was a big plus," he says. Had the file been smaller, he notes, "I could have tried animating it. This could still be a future consideration with a more powerful machine."

Spataru considered the Alhambra project a personal challenge, the goal of which was to explore the capabilities of computer modeling for bringing new life to ancient structures, and, he says, "to be able to demonstrate the capacity of the technology to other professionals researching the restoration of various types of difficult architectural elements." **CGW**

Diana Phillips Mahoney is senior associate editor of CGW

PAGEMASTER FLOWS WITH PARTICLE ANIMATION

A San Francisco production house uses its custom animation software to bridge live action and 2D cel animation

When an audience enters a movie theater, it does so with a willingness to believe in the celluloid world on the big screen, whether that world holds real people or animated characters. The challenge for moviemakers is to not violate that willingness.

In the movie *The Pagemaster* from 20th Century Fox, the producers and directors had to create both worlds—a real world and a cartoon world—and transport the audience from one to the other. *Pagemaster* moviegoers must believe that actor Macaulay Culkin

(as Richard) moves into a cel-animated fantasy world where he becomes a cartoon character.

In *The Pagemaster*, the fantasy world where books come alive was created solely with traditional 2D cel-animation techniques. To make the transition from the 3D real world to the 2D cel world, the directors and producers chose a technique that in many ways incorporates the art of both worlds: 3D animation.

In the movie, Richard, a fearful child, runs into a library to escape a freak storm. Once inside, he slips on the marble floor in the library's rotunda and falls on his back. When he looks up, he sees on the ceiling a mural of storybook characters. The mural begins to melt. Drops of paint become columns of liquid color that surround him. He runs between the columns. The columns melt into puddles that flow into a stream of paint. From the middle of the stream a dragon form takes shape. The dragon rears up, looks for Richard, then shapes itself into a raging wave which rushes after the child who is, by now, running through the library's "stacks." As the wave of paint splashes

USER SNAPSHOTS

OJ Simpson Trial Gets Graphical

Think burying your nose in a computer magazine will protect you from O.J. Simpson overload? Think again.

CGW became an appropriate passenger on the O.J. Simpson media bandwagon when the LA court system commissioned Trial Presentations Technologies—an LA-based consulting firm specializing in evidence presentation for settlements and trials—to design and help implement a multimedia evidence-presentation system for use in the former football star's double-murder trial. Once in

place, the system will provide immediate access to approximately 10,000 pieces of evidence, including documents, photographs, charts, graphs, video footage, and, possibly, computer animation.

According to TPT partner Thomas Reiter, the system comprises a '486 66MHz PC with a Videologic video scan converter, an Electrohome Marquee 8000 projector, a Kodak PhotoCD system, a Pioneer CD ROM disk changer, and standard 15-inch monitors for the lawyers and for the judge and the witness. The primary software is the Interactive Presentation System from Optical Magnetic Imaging Corp.

Before the trial begins (at

press time, a trial date had not yet been confirmed), the various pieces of evidence will be scanned and integrated into the system. At the trial, a TPT technician will retrieve information and/or zoom in on particular sections as requested by the attorneys. Witnesses and attorneys will interact with the system from lecterns positioned at the witness stand and in the center of the courtroom. Evidence will be annotated with a light pen and saved and retrieved in both hard copy and electronic format. Full-motion video footage and computer animation will be displayed from the laser disc. All of the digital information will be converted to an NTSC signal, so the local and network TV

pool can get a direct feed of what the jury is seeing.

Although, at press time, neither side had provided its evidence for digitization, Reiter guesses "there'll be a large amount of photographs, a fair amount of graphics—mostly by way of maps and diagrams—and some animation."

The animations will likely revolve around DNA structures and analysis, illustrating how the tests are run and some of the potential problems. "It's possible that there'll be some crime-scene scenarios, but I doubt whether they'll do a lot of that, and whether it will get



against the walls of books in the stacks, the real-world books are replaced with hand-drawn cels, a subtle preview of the animated world to come. Finally, the wave picks up so much speed that it swallows up the whole real world, including actor Culkin who is transported into the cartoon world.

It's not surprising that, after reviewing sample reels from special-effects houses, *Pagemaster* producers David Kirschner and Paul Gertz chose Xaos Inc. (San Francisco) to animate the liquid paint. Known for its special-effects work in the movie *The Lawnmower Man*, MTV's "Liquid Television," and the SciFi Channel's "Big Bang" opener, the relatively small animation production house has gained a large reputation for its unique artistic style often expressed in organic, flowing images.

To create the one-minute *Pagemaster* sequence, Xaos used three animation techniques, all of which utilize the company's proprietary software. First, to melt the mural of storybook characters, the artists used image-processing tools. As the mural melts, the paint begins to look so heavy (thanks to 3D

lighting effects) that it cannot help but begin to drip. The drips become columns of primary colors.

Second technique: "Because they wanted each drip to have a specific shape and direction, we created a procedural drip-animation tool," says Tony Lupidi, computer-animation supervisor. The tool, which Xaos describes as a "model-replacement animation tool," allowed the animators to create the heavy drips and to have frame-by-frame control.

The columns, however, were created with particles, so that when the paint hit the floor, it splashed, as paint would. The splashes—and much of the rest of the animation—use the third technique: Xaos' proprietary dynamic particle system.

With this system, animators use forces to control the shape and direction of particles. Further, the particle system can act on arbitrary obstacles. For example, to get the particle wave to bounce off the books in the stacks, the team built a 3D model of the li-



© 20th Century Fox

To create the liquid dragon, Xaos artists used pencil drawings from *Pagemaster* cel animators to define the shape, then applied forces within a 3D environment to try to contain their particles within similar forms as the animation progressed.

admitted if they do," says Reiter. In terms of all of the evidence, Judge Ito can blank out the screen and monitors while he decides on admissibility. ●

VR Program Helps Disabled Students

Although increased awareness of the special needs of people with disabilities has led to the removal of many physical barriers in recent years, conceptual obstacles still hinder some disabled people. In an effort to combat this, the University of Dayton Research Institute in cooperation with the Miami Valley Regional Transit Authority is sponsoring a multimedia/virtual-reality project called Train to Travel, in



which students learn to use public transportation so they can be more independent. The project involves first teaching basic bus skills—recognizing landmarks and what to do in an emergency, for example—using interactive multimedia. Next, the students board a virtual bus. Wearing a headmounted display with head tracking, students are surrounded by a computer-generated landscape.

According to Lyn Mowafy, project director and associate research psychologist in the

Human Engineering Group of the Aerospace Mechanics Division at the UD Research Institute, "The virtual bus rides offer a rendition of the scenery that is realistic enough for the students to recognize landmarks when they take the real bus rides." The virtual rides let the students test the waters in a non-threatening environment—they can't get lost trying to make a downtown connection, and there are no strangers on the virtual bus.

The Train to Travel VR environment was created using the dVISE interactive authoring software from Division Inc. (Chapel Hill, NC) running on the company's ProVision 100VPX platform. ●

Game Highlights Landfill Problems

What to do, what to do? Your county's landfill is full, and garbage is piling up. A new landfill is desperately needed, but nobody wants it in their



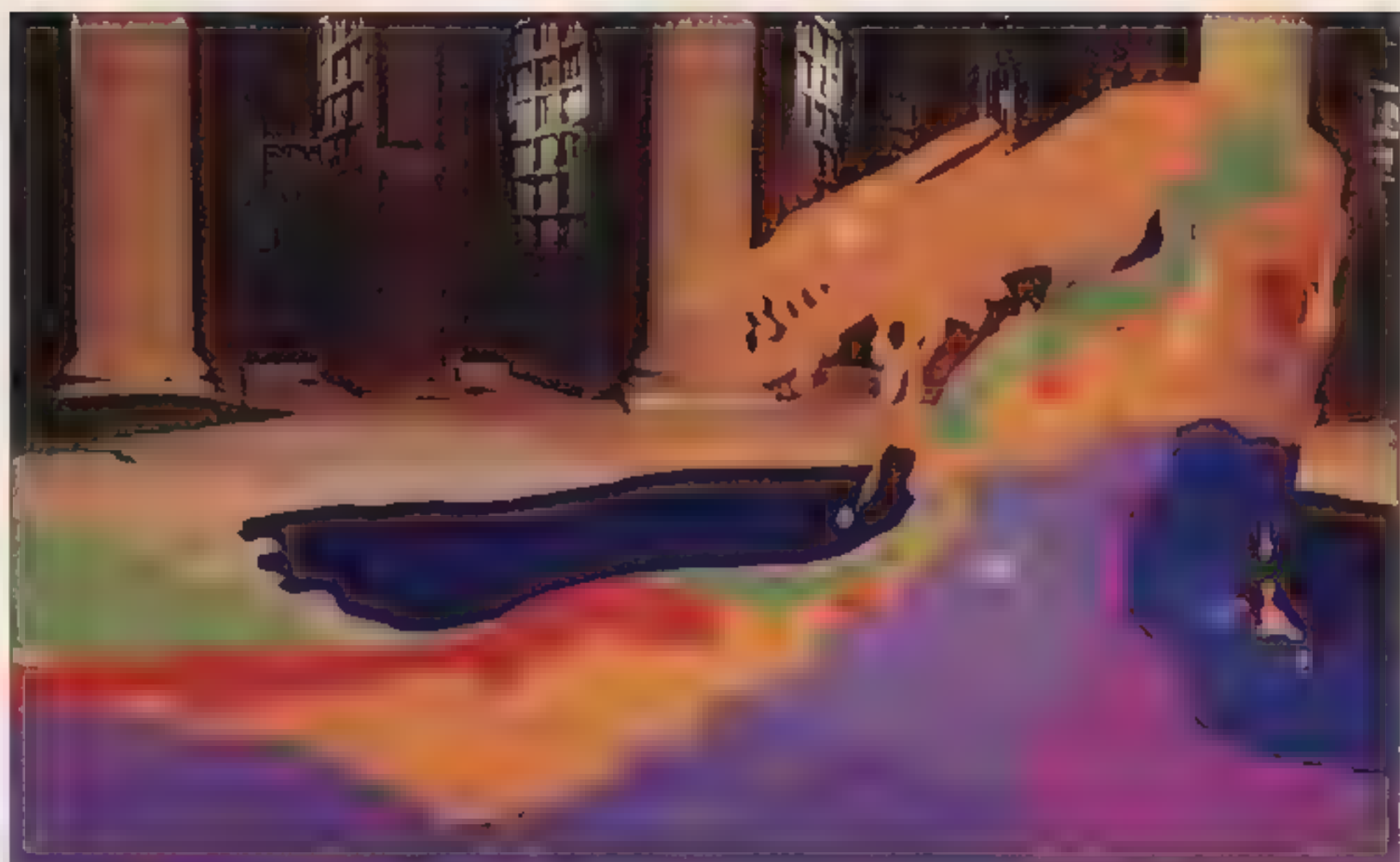
backyard. You have five minutes to propose a solution.

Such is the challenge faced by players of a game called "Not in My Backyard," sponsored by the Nature of Illinois Foundation for the Illinois Department of Energy

brary that they used as an obstacle. Within a sequence, there could be as many as 50,000 collisions, since every particle can affect every other, according to Lupidi.

To squeeze the particles into the required shapes, animator Cassidy Curtis applied forces such as gravity. The shapes came from pencil sketches, provided by *Pagemaster* cel animators, that were scanned into the Xaos system. Sometimes, the particles behaved erratically, like popcorn. "It took maybe 10 weeks of trial and error," says Mark Malmberg, Xaos president and creative director. Once satisfied with a shape, they turned the particles into objects that could be rendered, using special software that creates a surface "skin," using particle density as a guide. With the resulting 3D model, they can apply rendering techniques such as motion blur, shadows, and lighting. Splashes trailing off the dragon's head were painted in by artists at MotionWorks (Hollywood) using that company's digital ink and paint system.

Because the sequence moved from live action to 2D cel animation, Xaos had to composite the 3D animation sequences with live



© 20th Century Fox

Animators at Xaos Inc. used the company's proprietary particle-animation system to create a raging wave of liquid paint.

action and blend the animations with 2D cel animation—which meant working with two directing styles to get the timing, personality, and emotion that would make the transition successful. "When we started, we didn't realize how much we would learn," says Plotkin. "The things that were easy for

them—explicit control and the ability to draw anything—were hard for us when we were working with particle-based animation. We all had to learn new languages." **CGW**

Barbara Robertson is CGW's West Coast senior editor

and Natural Resources. The game, which was part of an interactive display at the 1994 Illinois State Fair in Springfield, demonstrates the GIS tools and data-collecting work done by the Department's Scientific Survey Division. It is based on ArcView Version 2 desktop GIS software from ESRI (Redlands, CA) running on Sun Microsystems' Sparc 5 workstations

To play the game, users first select a county (all of the state's counties are included). They then consider different planning scenarios based on photographs, graphs, charts, maps, and text that help them to weigh such factors as a landfill's impact on water supplies, natural sites, recreation areas, and public

opinion, as well as compliance with regional and national regulations. Users are given scores for their solutions based on such factors as the time it took to reach the solution, the estimated cost of the proposed siting, and the potential environmental impact. ●

Short Animations Strive to be Childish

Over the past few years, advances in computer technology have enabled animators to replace conventional tools and techniques with digital ones. In some situations, however, the sleek, high-tech look that is often associated with CG images is being abandoned in favor of a more natural, less-sterile look.



A series of 26 one-minute interstitials called "Stickin' Around" created for CBS by the Toronto-based Nelvana production house demonstrates this approach. The series is based on child-like drawings and a free-for-all coloring style to give the impression that the cartoons were created by kids. The imagery was generated via digital ink and paint; the animation was generated traditionally.

According to series producer Peter Hudecki, the style of paint used for the shorts—a thick scrawling line with the fill color "blobbed" in or near the line—

would have challenged the traditional click-and-fill techniques of most digital paint systems, but was facilitated by combining the capabilities of various software programs. The primary software was Linker Systems Animation Stand Adobe Photoshop and Fractal Design's Painter were also used. A special hardware configuration was designed to handle the animation process from scan and paint to broadcast output. The networked system included six Power Macintosh 6100s for paint stations, two Macintosh Quadra 950s—one for art direction and color models and one for high-speed scanning with a Fujitsu scanner, and a Power Mac 8100 for compositing the painted cels. —DPM



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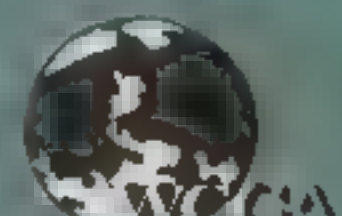


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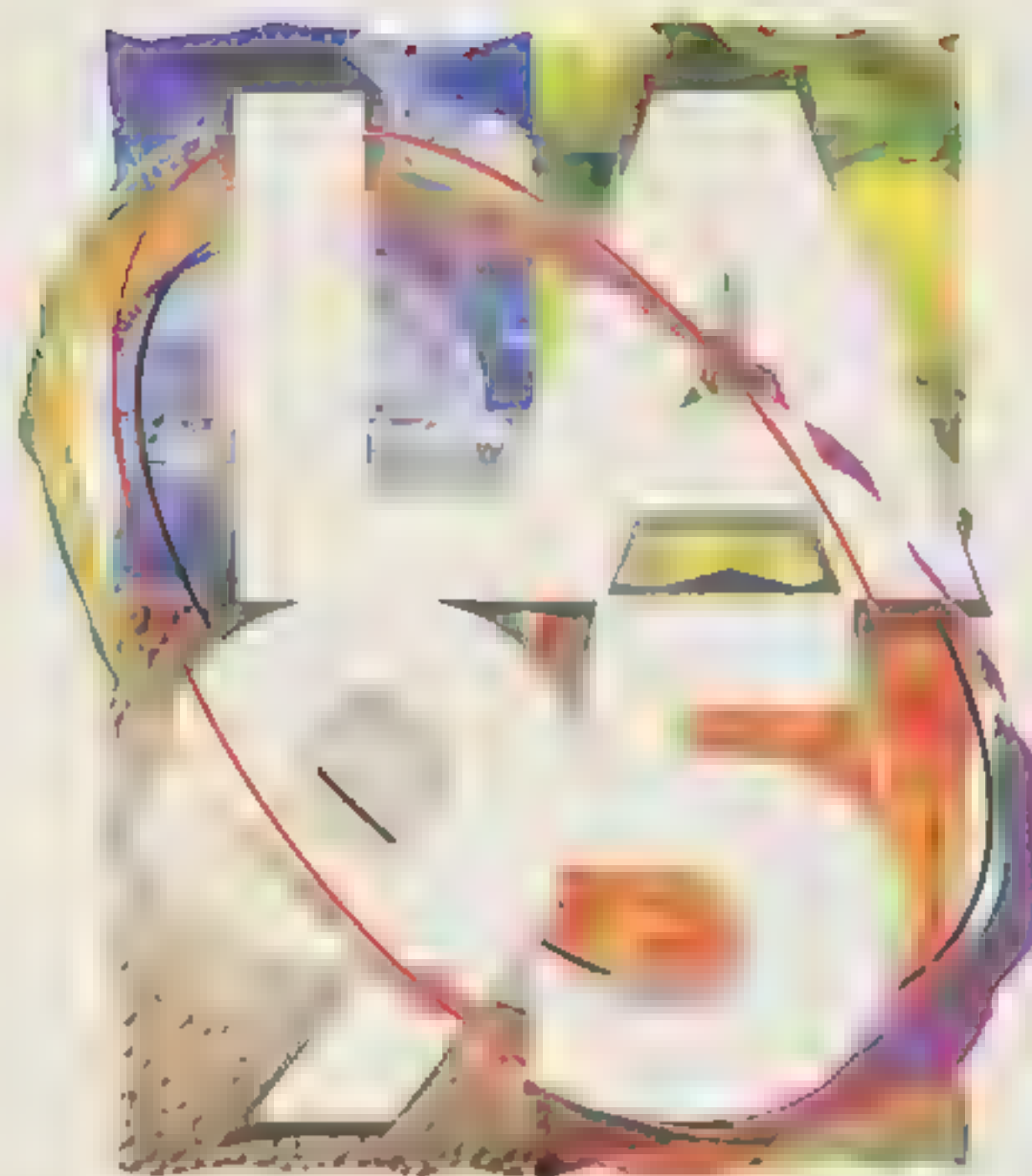
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MODELING VIRTUAL WORLDS

Helpful tips for developers of virtual environments

The issues you must consider when creating 3D models for use in interactive or virtual environments are quite different from those involved in typical rendering and animation modeling. While the goal of most 3D artists and animators is to make their models appear as detailed or as photorealistic as possible (which they generally achieve by creating models comprised of many polygons), the goal of developers of real-time virtual environments is to create models that aren't polygon-intensive, as the use of low-polygon models will increase the performance of the virtual world. In this way, if you're flying through a model of, for instance, a terrain, and the branches and leaves on the trees in the terrain *aren't* polygon-intensive, you'll fly smoothly through the terrain instead of hopping around it.

Some people argue that model size isn't an extremely important issue to consider when the models are being created on high-end workstations such as those from Silicon Graphics and Evans & Sutherland. Nevertheless, many developers who work on such systems use "smart routines" to reduce the number of polygons visible on the computer screen at any given time. Often called Level of Detail (LOD) routines, these smart routines use lower-polygon models away from the camera (where they can't be seen well) and add in more detailed models as they get

closer to the viewer. One example of the use of LOD routines is Evans & Sutherland's sleek-looking hang-gliding demo. This demo, which allows participants to hang-glide through a richly textured cityscape, never has more than 2000 polygons being rendered in any one frame; thus frame rates are maintained at a realistic-looking 30 frames per second.

On a PC, it's even more critical to keep polygon counts low. However many PC-based modeling packages create models composed of individual faces, as opposed to meshes or arrays of faces comprising a single entity, thus slowing performance dramatically.

Modeling packages have different ways of dealing with this problem. The modeling package I use, Autodesk's (Sausalito, CA) 3D Studio, outputs an entity called a Polyface Mesh. This entity is efficient for modeling virtual environments, because it defines the geometry as a series of vertices first, then it connects the faces.

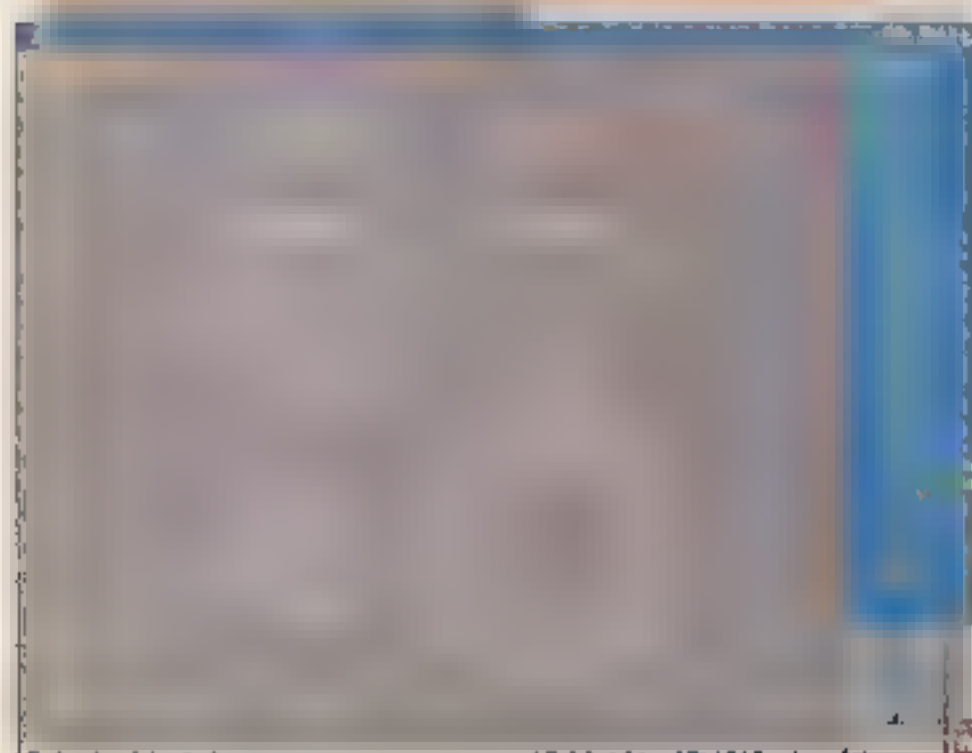
To create virtual-world models using 3D Studio, I always follow a number of rules. First, if I create models using primitives (spheres, hemispheres, cubes, tori, cones) such as those found in 3D Studio's 3D Editor, I always set the value of these primitives as low as possible, keeping spheres limited to only eight sides. If I assign a high value to these primitives, my object will consist of an overabundance of faces and polygons, and it will require more processing power

to redraw the object in real time. **Figure 1**

Primitive cones pose an additional problem. When creating a primitive cone, even though it may look like I set the second diameter to zero (thus creating a pointed cone or pyramid), when I zoom in on the cone I can see that the tip is really made of many vertices that are connected to many small polygons. To get around this problem, I use 3D Studio's Modify/Vertex/Weld command to weld the vertices together, thereby creating a single point and lowering the face count of the object. **Figures 2 & 3**

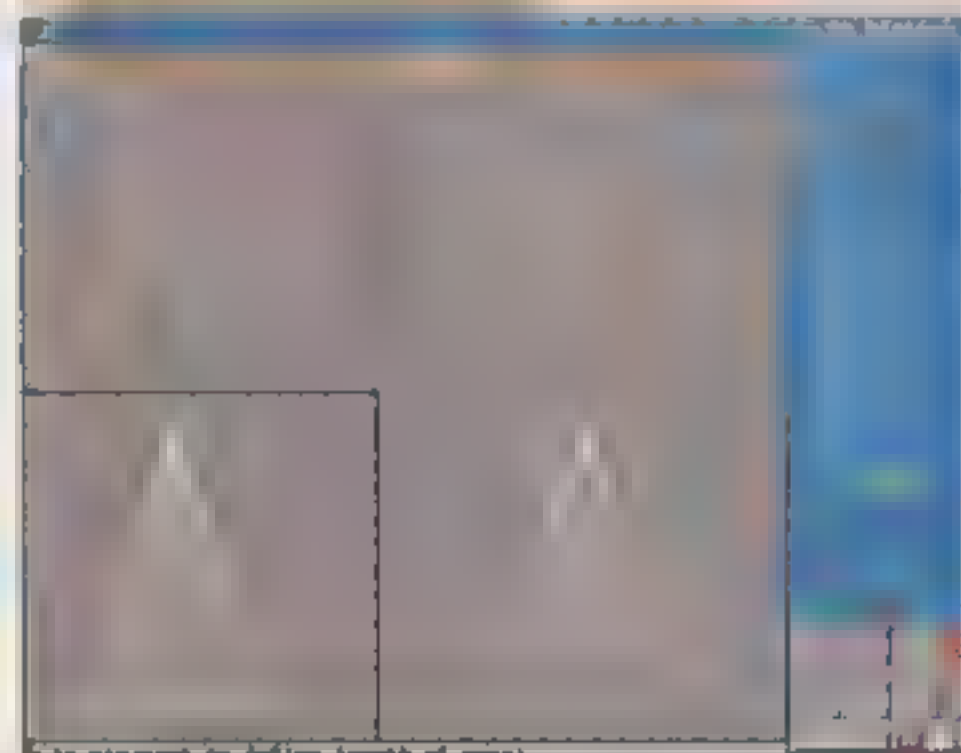
The Modify/Vertex/Weld command is also helpful for merging vertices that are sometimes created unnecessarily (they're unnecessary because they will never be seen). You can use this tool to, for instance, weld the vertices located at the top of spheres or hemispheres; doing so increases the real-time performance of the virtual environment without sacrificing detail. This command also comes in handy when creating objects that come to a point. For instance, a recent project called for me to create a nautilus shell. At the tip of the shell were a large number of unnecessary vertices, so I used this command to weld them together, thereby simplifying the object. (Note: Within 3D Studio's 3DS.SET file, I can change the Weld-Threshold value. The value specified describes the area, in current units, within which the vertices must lie in order for them to be welded. By increasing the value, I

Figure 1



Set the value of the primitives in your models as low as possible, keeping spheres limited to only eight sides.

Figure 2



The tip of a primitive cone is made of many vertices that are connected to many small polygons. Use 3D Studio's Modify/Vertex/Weld command to weld the vertices together, thereby creating a single point and lowering the face count of the object.

Figure 3

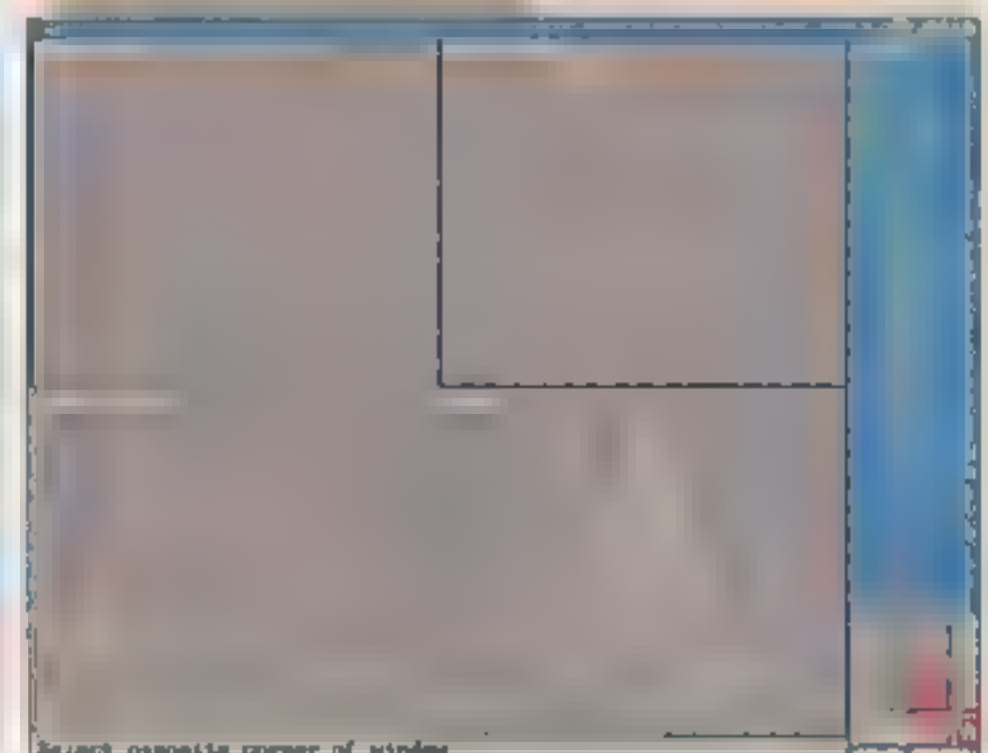
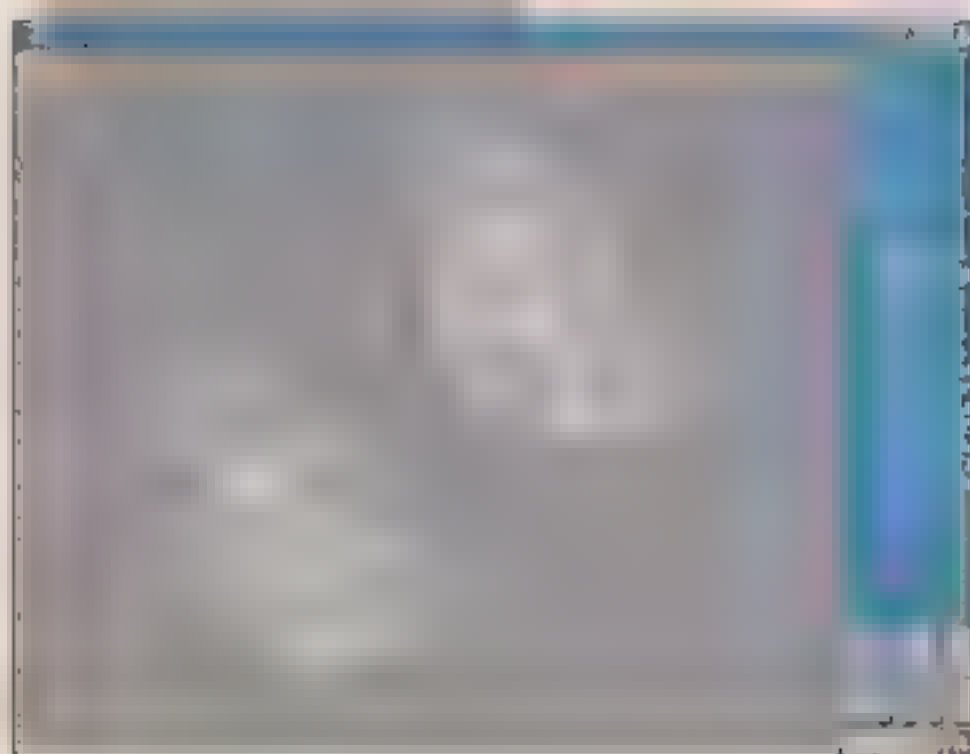


Figure 4



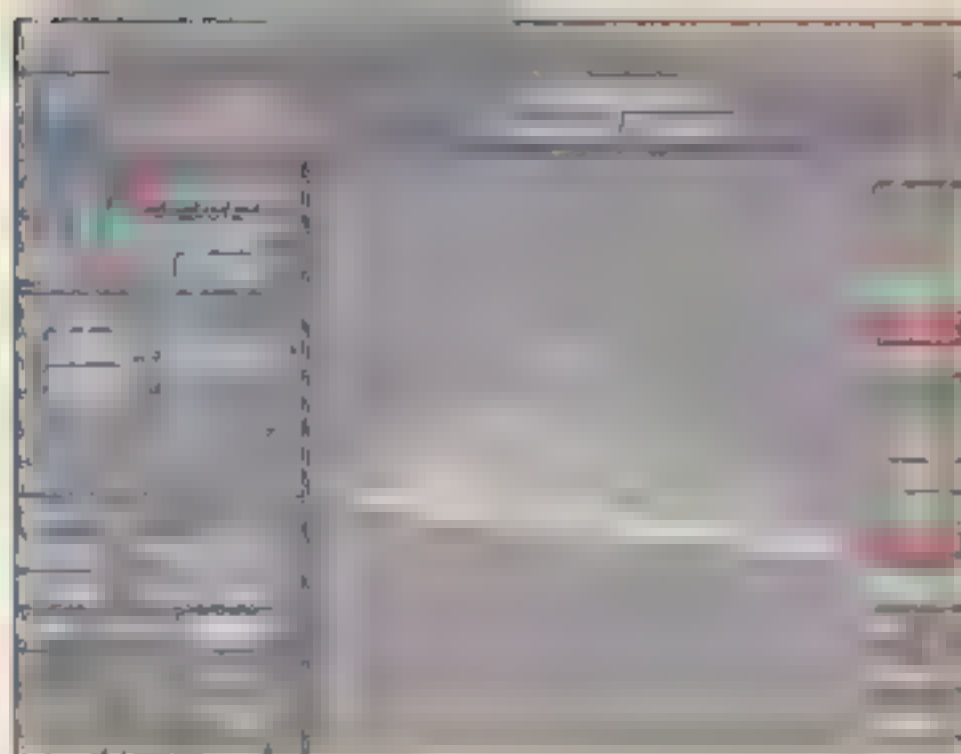
View your models using the Display/Geometry/All Lines command and set the display to show "all lines".

can weld more vertices and reduce the number of polygons in my objects.)

Another problem that sometimes crops up when modeling virtual environments are models that have been created using extruded 2D AutoCAD entities, such as lines and circles. Even though these entities look like they're three-dimensional to participants in the virtual environment, they are not true 3D entities (in fact, most virtual-environment software toolkits don't recognize these types of entities). Lofted 2D entities created within 3D Studio's 2D Shaper, on the other hand, are Polyface Meshes, which are true 3D objects. Again, the most critical thing to remember when lofting objects is to set the step value at zero or as low as possible in the 2D Shaper before lofting and importing the object into a DXF file. If this is not done, each edge will be broken into multiple segments, which increases the polygon count of the object to the point that it will be impossible or impractical to use in a virtual environment. To help me view my models and make sure I am creating them as optimally as possible, I always use the Display/Geometry/All Lines command and set the display to show "all lines" as opposed to "edges only" **Figure 4**

Another trick I use when building models for use in virtual environments is to delete faces I know will never be seen by the viewer. For example, if a box will be sitting on the floor of my virtual house, I know the bottom faces will go unseen, so I delete them. First I select them using 3D Studio's Select/Face/Quad command with the window option active from a perpendicular view. Then, using the Front View, I select the bottom of the box by drawing a window around only the bottom portion of the box. (I never attempt to delete faces one at a time, as the risk of

Figure 5



Optimize, an IPAS plug-in routine from The Yost Group that works within 3D Studio, allows users to load a model and optimize its number of faces and polygons based on the angle of its normals.

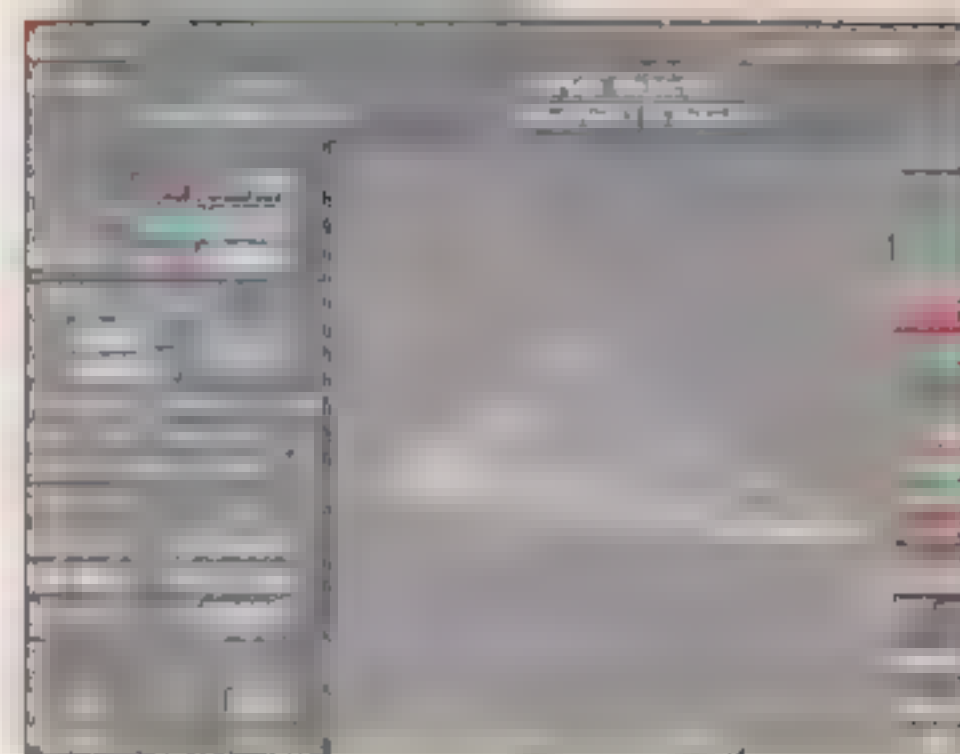
error is too great). Then I delete the faces using the software's Modify/Face/Delete command.

Normals and backface rejection are additional issues critical to developers of virtual environments. When I'm testing the normals of a model in 3D Studio, I always make sure Two-Sided rendering is turned off. If the normal is facing the wrong way in rendering, it will be invisible when I view the rendered image. It will also be invisible in most virtual environment packages. When this happens, I use 3D Studio's Surface/Normals/Flip command to flip the faces and unify the normals. I use these tools to manicure my models so they look the way I want them to look before I export them to my virtual environment software. (Note: It is possible to use two-sided rendering tools in some real-time software, but this will significantly reduce the performance of the virtual environment. Also, meshes which are closed in both directions typically come into virtual environments as one-sided objects. When you fly inside them, they disappear.)

A great tool for optimizing models that I've already built, but which may be too large for use in virtual environments, is the Optimize IPAS routine from The Yost Group Inc. (San Francisco). A plug-in that works within 3D Studio, this tool allows users to load a model and optimize its number of faces and polygons based on the angle of its normals **Figures 5 & 6**. Faces with comparative normal angles that are greater than what were specified in the Angle file are not removed. Thus higher angle values result in greater optimization.

A final issue developers of virtual environments ought to consider is that of texture maps. I use texture maps instead of detailed models for

Figure 6



objects—such as doors, bookcases, and most architectural detail—that will be viewed from a distance as well as up close, because the real-time performance of the virtual environment is improved when I use photos of detailed doors and shelves full of books as opposed to building these out of complex models. I also use textures for all plants and trees instead of modeling them, especially when I want to show the outdoors through a window. (It is important to note, however, that when texture maps fill the screen, the closer the viewer gets to them, the slower the frame rates can become.)

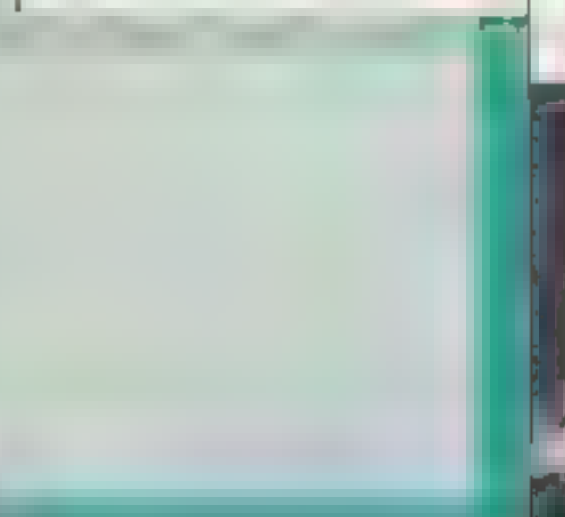
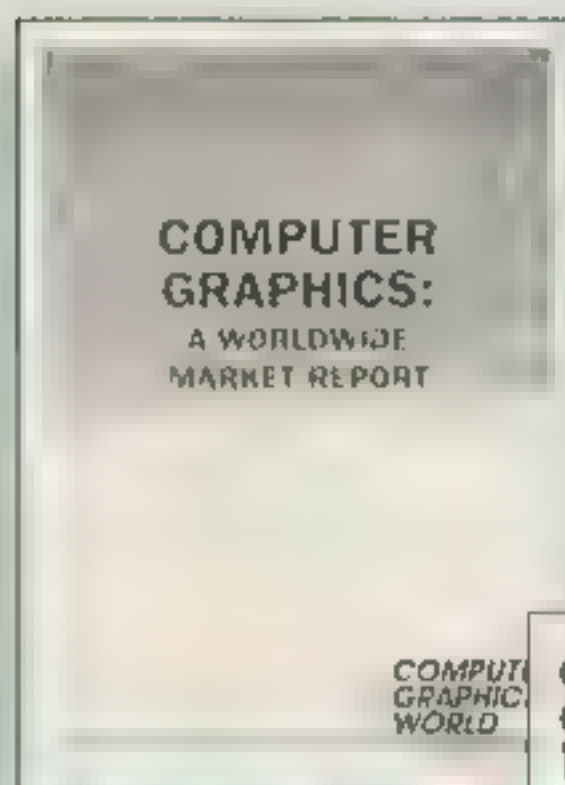
Sometimes, when I am ready to test a model designed for a virtual world but I don't want to port it into any particular virtual environment toolkit right away, I use the NAVFlyer from MicronGreen (Gainesville, FL). This shareware flyer allows me to fly through DXF models using the keypad for navigation, and it allows for six-degrees-of-freedom flying with speed control for both translation and rotation.

In summary, if you're modeling virtual environments, it may be helpful if you follow the tips I've outlined here. Create low-polygon, closed-polyface meshes; try to model without rendering both sides of the object and have as few objects as possible, if you don't need to move, color, or manipulate an object, group it with all other similar objects into a static model. The fewer objects you have to keep up with, the faster the performance of your virtual environment. **C&W**

Contributing editor Douglas King is a 3D animator and consultant for the entertainment industry. His company King/Wheatley Creative Design, is located in Turlock, California. He wishes to thank Angela Pate of MicronGreen Inc. (Gainesville, FL) for her assistance with this article.

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CIRCLE 28 ON INFORMATION CARD

FEELING FRUSTRATED? EXPLODE SOMETHING

Using particle systems—in this case, GIG3DGO—you can blow up just about anything. And we did.



It's been another "vu ja day"—moderate to high aggravation quotient, barking clients from hell, "deadlines" that won't quit. Feeling out of control? Why not blow the hell out of something! *Doom II* notwithstanding, it works for us at Forcade & Associates.

And what better way than with a series of particle bursts from a plasmoid blaster ending in an explosion. Our target, the yellow "Have a Nice Day" happy, squeaky, perky face. YES!

Our software of choice to blow Mr. Happy Face to kingdom come was ElectroGIG's (San Francisco) GIG3DGO. GIG's particle system is quite intricate, and as such, we're not going to include all the exact settings for each step. Working with particle systems is like one huge experiment, so these variables won't mean much outside of this application anyway. However we will cover the basic principles of how to work with a particle system in general.

Particle systems are collections of variable objects that have the unique property of being able to change behavior over time. You can vary the objects' size, color, shape, position, or texture at any point in an animation. You also can make them interact in numerous ways, either with each other or with their environment. As such particle systems are well-suited to creating ani-

mated natural-phenomena effects, such as explosions, smoke, fire, and even plasma blasts. Our happy-face sequence actually consists of three particle animations: one for the initial energy burst, another for the plasma stream from the blaster, and the last to explode the happy face.

But before we get into how to create the particle systems, here's a quick overview of the scene elements. Our animation consists of a basic

By Tim Forcade and Mark Anderson

happy-face shrine complete with cheap, plastic-engraved column and blue transparent shower curtain as well as tiled floor and plasmoid

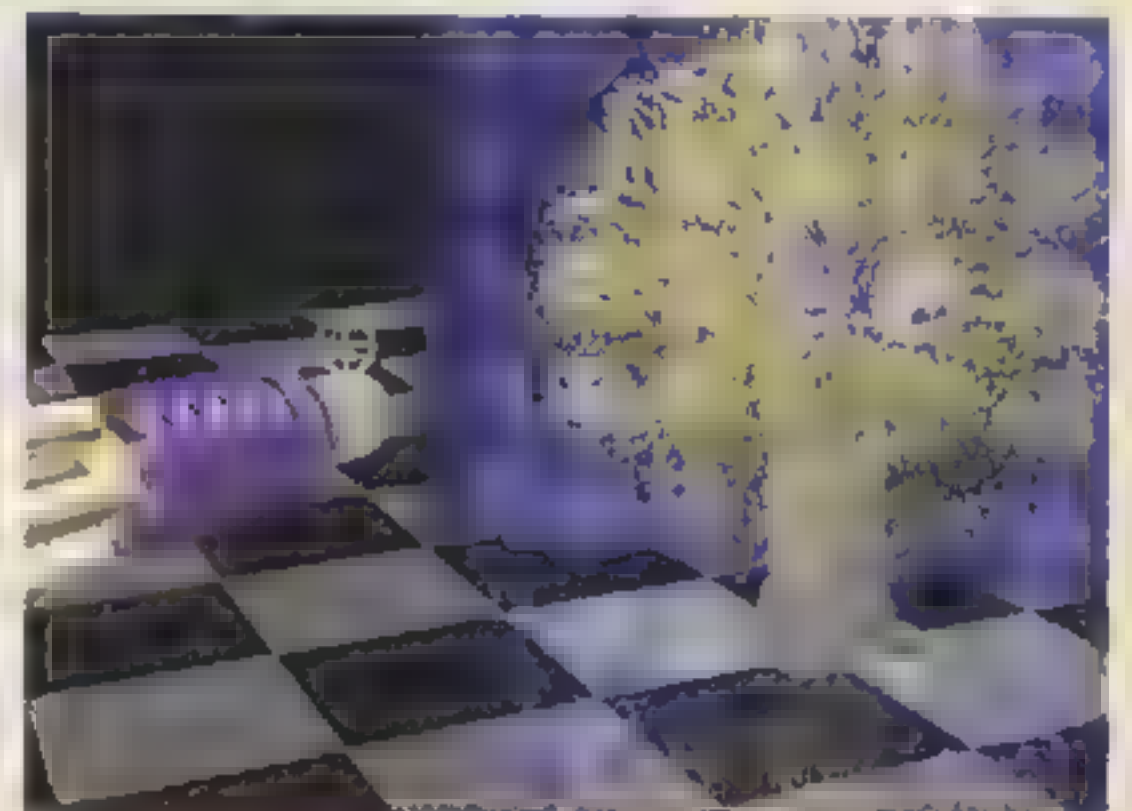
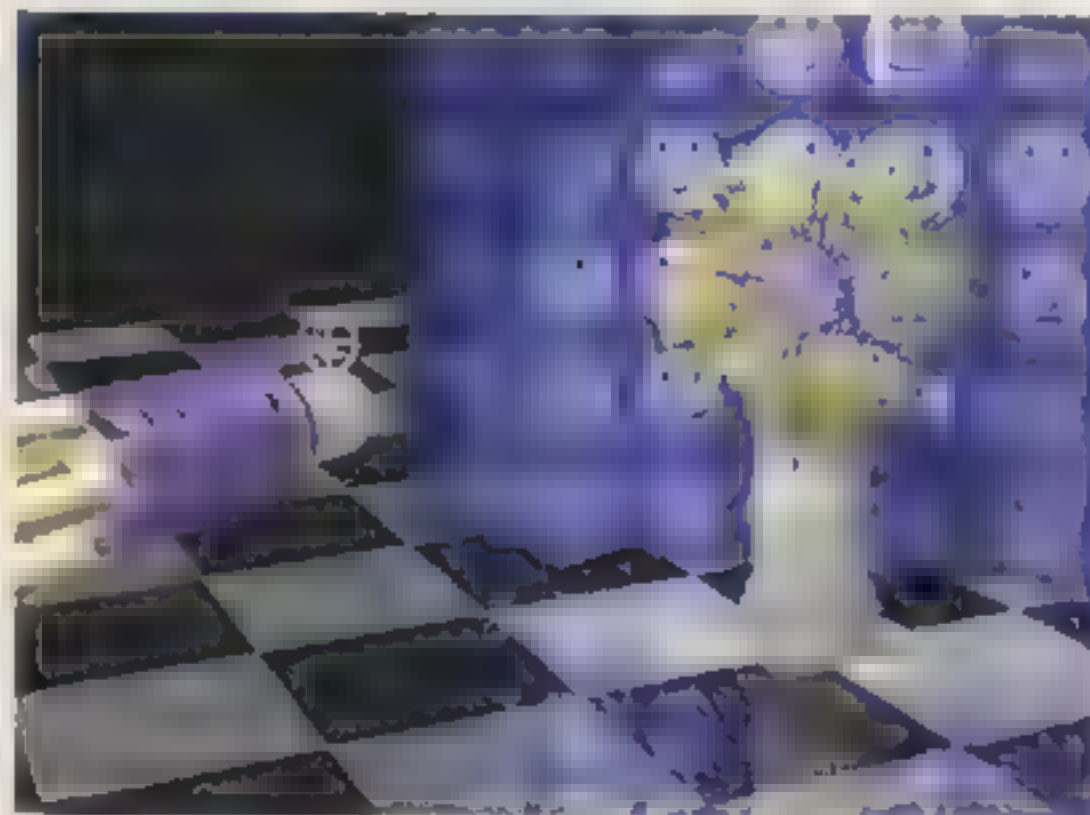
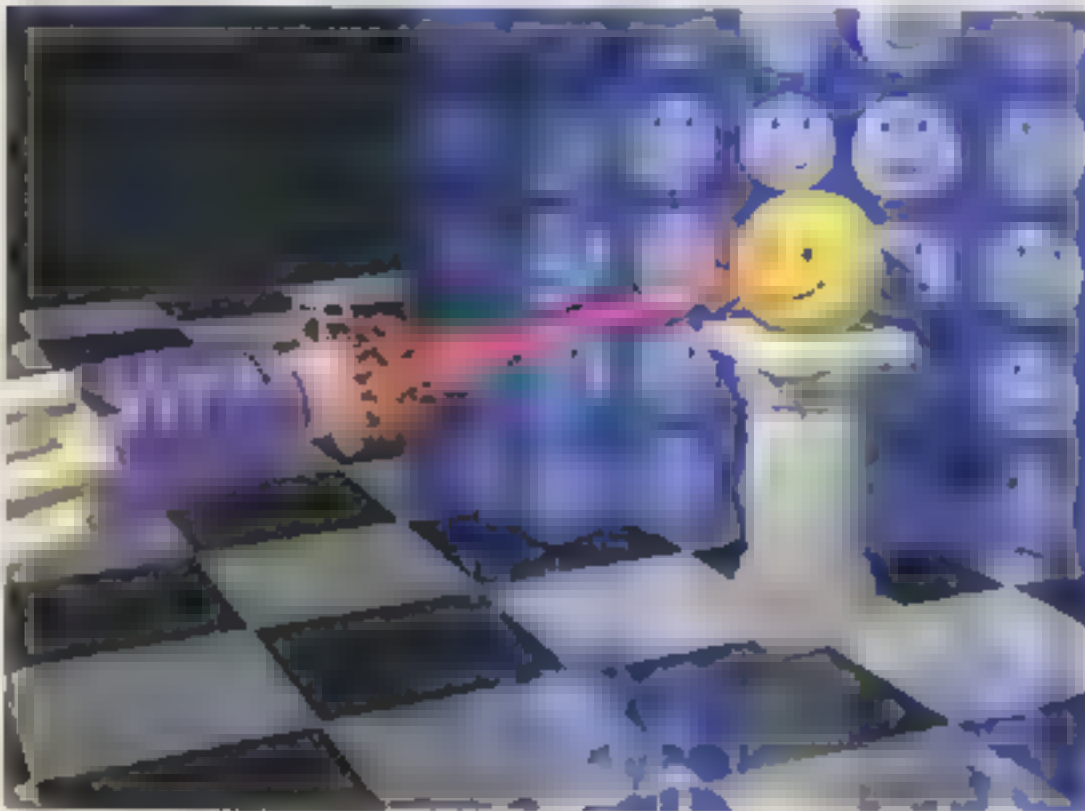
mand, while using TransformMap to display the image map on the sphere so we could interactively move, scale, and rotate the map in relation to the model!

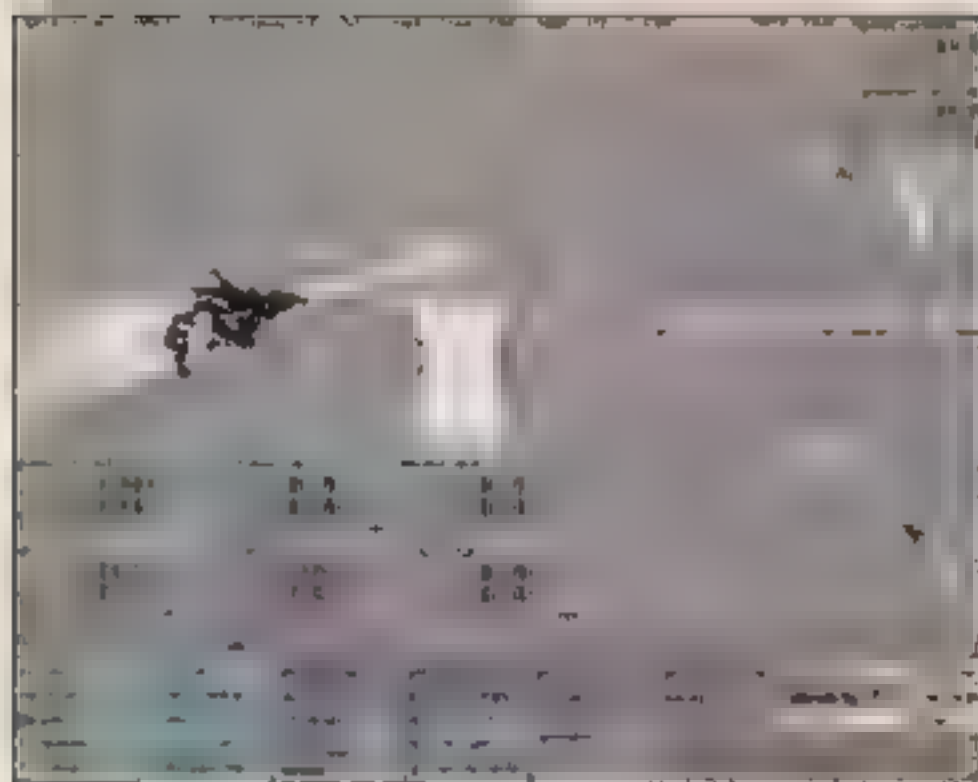
We also created the shower curtain's texture map with TransformMap as well as with the Scale command, which automatically tiled the number of images needed to cover the curtain's surface. Prior to this step, we changed the color of the map from yellow to blue using Mapfactory's arithmetic functions; these let you change the color of any image map using addition, subtraction, multiplication, and color replacement between map images. On the tiled floor, we used a procedural library texture with reflection added, and on the remainder of the objects, we used simple combinations of diffuse, specular, and transparency values.

Final touches to the scene included two lights. The first, a shadow spot, lights the scene from above; the second, a local spot, lights only the initial blast and the plasma stream. The material attribute we used for the plasma blast was a simple red transparent material. And for the explosion, we used the texture from the happy face, using the original texture position to translate the texture to each particle.

blaster, all of which we created using various solid primitives and GIG's NURBS modeler.

To texture-map the happy face (a sphere primitive), we selected an Adobe Illustrator drawing of the happy face expression, re-opened the file in Adobe Photoshop, colored the face yellow and black, and saved it in TIF format for use with GIG's Mapfactory. Mapfactory works with a library of procedural textures or with your own images and lets you create and composite image maps, including texture and bump maps. You also can assign surface attributes, such as intensity or specular. We applied the TIF image to the sphere via the Diffuse/Attributes com-

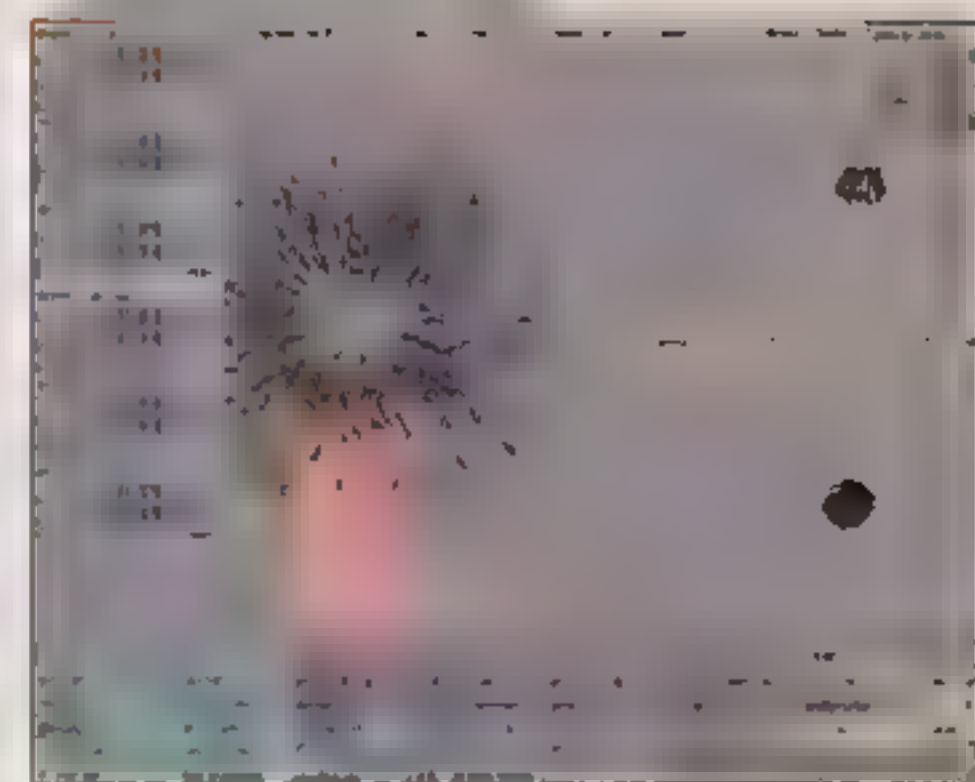




This view from GIG Particles shows the muzzle blast—the first particle system—highlighted in black. Note the hexagonal icon around the plasmoid blaster; this represents the vortex field. The variables controlling the particle system are shown in their individual dialog boxes.



Here, the beam system and its associated parameters are shown. A uniform field was used to create a continuous beam. A spot field—represented by a white square centered on the sphere—spreads the particles at the point of impact.



The explosion, highlighted in black, was created with a negative sink field, shown as a green icon at the center of the sphere. The streaked lines show the paths and blur of each particle. The pink highlighted objects are collision objects of the explosion.

Now for the particle systems. The animation consists of three particle-system segments—an initial energy burst, a plasma stream, and an explosion—which we set to run in sequence. The effects we planned weren't possible to achieve with just one particle system.

GIG particle systems consist of one or more emitters, which function like a garden hose spraying a variable number of particles out into 3D space. The number of particles that result from a conversion is directly proportionate to the size of the model. Furthermore, you can take a converted particle system and reconvert it to its original form, which is useful for making changes to your model and, thus, the overall shape of the particle system.

You also can choose from numerous particle emitter shapes, a few being point, ball, cone, and line. Additionally, you can convert any 3DGO model into a particle system. After experimenting with several options, we chose a point-particle system—which shoots particles from a single, small point—for the energy burst.

There are more than 20 other parameters that can influence each particle emitter. Among these, the Pulsetime Mean Value (PMV) and Lifetime Mean Value (LMV) are essential. The former controls the interval—in frames—between the emission of particles; the latter controls the number of frames for which the particles are visible. Each parameter also has a variance value that adds a randomizing effect based on the mean value; this keeps the parti-

cles from looking or acting too uniformly.

Some particle systems, including GIG's, will include a number of other parameter settings. GIG gives you control over the Radius, which sets the size of the particles; Startspeed, which sets initial particle velocity; and Gravity. Pulse-offset lets you set when an event will start; this is the feature we used to time the start of each of the three particle systems. Timestep sets the overall duration for each particle system; this was essential to finetuning the speed of the particles, making the initial energy burst slightly fizzy. Again, we experimented with these settings until we got the "right" look for our energy burst.

We're not finished yet, though—there are even more options to tweak. GIG also provides a number of fields for each particle stream, including Force, Fluid, Velocity, and Ejection. Briefly, Force fields shape the particle flow according to numerous parameters, including mass. Fluid fields simulate a moving fluid with variable viscosity. Velocity fields affect speed, ignoring the effects of mass or gravity. And Ejection fields constrain a particle system so it emits in a specific direction. You can assign multiple fields to a given particle system. Plus, fields have multiple variables, too, any of which you can animate. To impart a swirling motion effect to the energy burst, we used two Velocity fields—Vortex and Uniform. We actually used one of Vortex's field parameters, Spiral, to get the spiraling effect we were after. And we used Uniform's Power parameter to influence the

shape and size of the energy burst.

As you might imagine, getting an idea of how all these variables will interact could be difficult and time-consuming. GIG simplifies the process with simulation, which uses wireframe stand-ins to represent particles as they move and interact. While a simulation is running, you can interactively change any particle-system parameter or field value and view the result as a series of lines or wireframe objects.

We did most of our particle-system modeling in simulation mode, experimenting with various settings to see how they would work together. For instance, the burst emitter initially sent the particles out in a straight stream. So, while running in simulation mode, we added the Vortex field, and the particles appeared to spiral inward more slowly. Then we used the Uniform field to force the spiraling particle stream into a single vortex curve.

With the first particle system tweaked, we moved on to the second—the plasma stream. For this we used another single-point emitter, employing a Spot Force field and a Uniform Ejection field for refinements. The Spot Force field caused the particles to spread and accelerate away from the point of impact (the happy face), and the Uniform Ejection field focused the particles in a specific direction. We set the PMV for the point emitter to make the stream continuous. Additionally, we set the Startspeed to 9 to make the animation of the beam run more quickly (to create a more realistic-looking laser



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blast). We also used Tailsize—which lets you shape the particle stream by sizing the head and tail of each particle—along with a blur map to make the plasma stream look more fluid.

Now for our last particle system—the explosion. To create the explosion, we converted the happy-face sphere into a particle system. We did this via the Convert command, which provides parameters for particle density, randomness, distribution, and hollowness. In this case, a density setting of 30 provided the desired look by covering nearly the entire surface of the sphere with particles. (We kept the default values for the other parameters.)

We set the PMV variance to make the particle distribution more random, thus preventing the explosion from starting and ending as too distinct a spheroid shape. We also set the LMV variance to make the end of the explosion appear nonuniform. Then we set Gravity so the explosion's particles would settle slightly.

The most direct way to explode the particles from the center of the sphere was to use a negative Sink field and Ejection field, which combined to blast the sphere in all directions. Sink fields

originate from a point and pull particles either toward (positive) or away from (negative) their origin; we used a negative setting to project the particles outward. The Ejection field prevented the particles from spreading in too regular a pattern after colliding with the happy face. We then added a Noise field to make the particles flutter slightly as they move away from the sphere.

We used collision objects on both the plasma stream and explosion. For the plasma stream, we used the happy face as a collision object, and the happy face used the shower curtain, column, and floor as collision objects (we had previously grouped these). We then set the explosion's resilience value so the particles would bounce when they reached the floor or column.

Our next step was to use simulation to preview and time the sequence of the three particle animations. Here, we could interactively vary the Pulse-offset parameter to offset the start of each particle animation until we got the look we wanted.

With our simulation work complete, we used the Record/Parameters command to generate the timecurves for each animated parameter. Timecurves are graphical representations of a

function; there is a timecurve for every variable. After recording parameters, you can edit the resulting timecurves. Finally, once the sequence is to your liking, you can render to frames and record the result. Don't forget: Render quality will affect what is visible in your final animation. You may want to run a render test first to make sure you can see all the particles.

That's it. Our basic particle blast is in place. I'll eventually add several more particle systems before final rendering (space constraints prohibit our detailing these). For instance, the plazmoid blaster will need several cylindrical particle systems to produce a sequence of glowing rings that build as the blaster charges to full power. Then there is the steamy smoke that drifts out of the blaster's muzzle. And of course, a wisp of pale yellow smoke—the last of the happy face. Have a nice day ... NOT! **CGW**

Tim Forcade, CGW contributing editor, and Mark Anderson, animator, are working on "Have a Vu Ja Day" at Forcade & Associates, a graphics and animation production company (Lawrence, KS and Evanston, IL).

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WAVEFRONT CREATES A CLASSIC IN COMPOSER 3.0

With the 3.0 Upgrade of Composer—Wavefront's software for compositing image sequences and creating special effects for video, film, and games—Wavefront makes what was once a functional program more approachable and intuitive, and thus, more useful.

Basically, Composer or-

ganizes its new workspace into a menu bar, toolbox, toolbar, multiple image swatches (small, square representations of image sequences), a timeline-curve graph, and a message window. You create compositions by loading still and moving sequences into the timeline, which represents each sequence as a color-coded horizontal bar. You then link each sequence with a transition, such as a dissolve, fade, or wipe. You also can apply any number of special effects—including morphs and warps or 2D and 3D rotates and spins—as well as apply various timing events, such as freeze, repeat, or cycle.

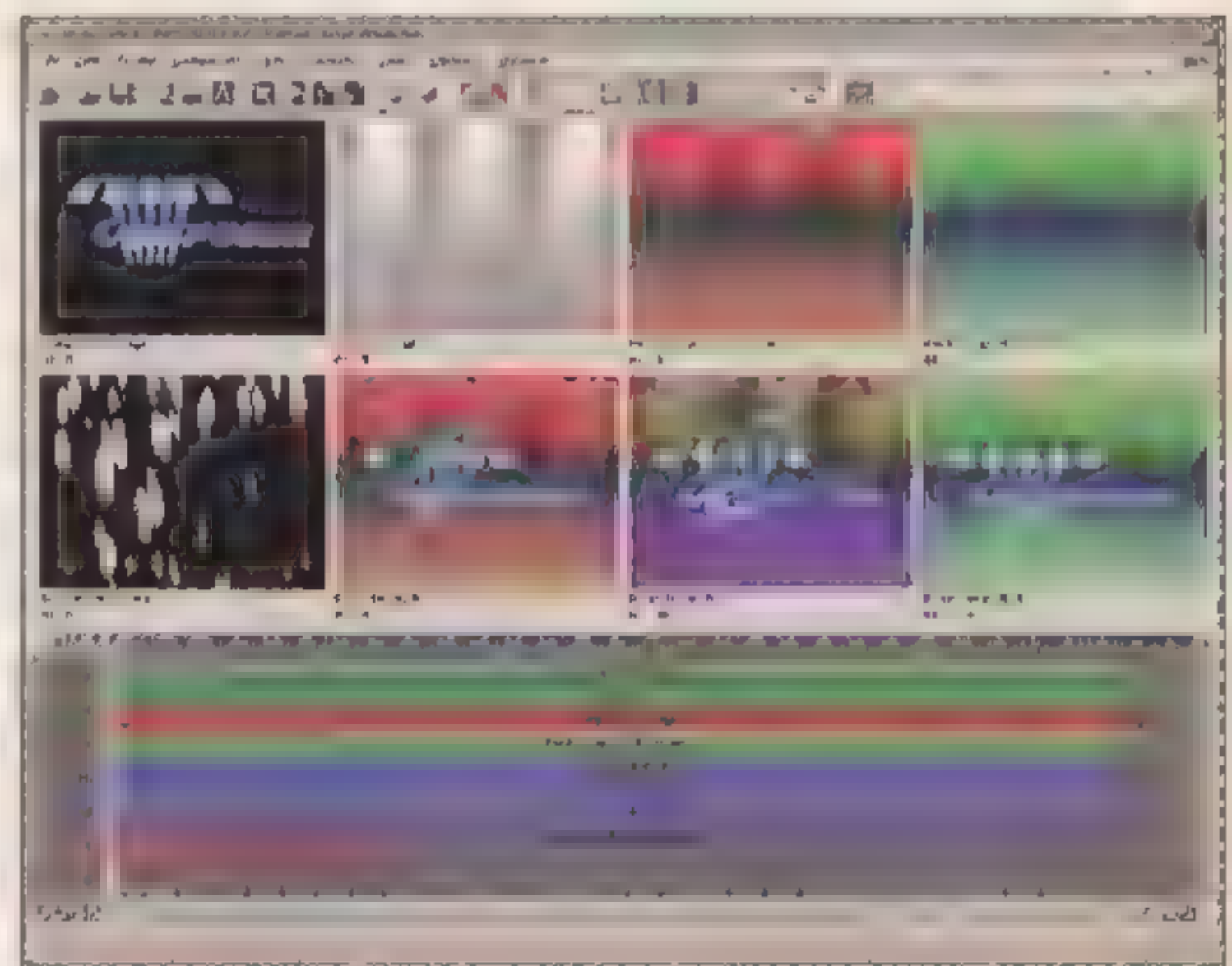
Working in this environment is straightforward and intuitive, mostly due to Composer's new Motif-based user interface. Its overall elegance and ease of use are dramatic improvements over the previous version, which wasn't icon-based and simply lacked the finesse—not to mention functionality—of this release. For example, there are tear-off menus that let you float frequently used functions. Numerous keyboard shortcuts streamline command use, as do a number of timeline shortcuts aimed at accelerating and simplifying the manipulation of complex events. Plus, you now can drag and drop images or selected pixel information between windows or menus.

The new toolbox provides access to various tools, depending on your currently selected command. For example, you can Pick, Move, or magnify the swatches that represent your image sequences. Composer's new toolbar displays a horizontal row of multicolored icons that corre-



special-purpose dialog boxes for setting keyframes and controlling effects parameters. Plus, an on-line tutorial takes you step by step through several essential processes.

Displace is one of Composer's most fascinating new effects. Here, the author used a bubble animation to produce a watery wipe across a logo and animated background. The image swatches and timeline window combine to provide a clear picture of each element in your composition.



spond to frequently used commands. You can customize the toolbar to suit your own needs, and you can create custom icons using the accompanying Pixmap application.

To further facilitate your work, Version 3.0 lets you perform many adjustments interactively using any image swatch. Say, for example, that you've added a rotation event: Double click on that event in the timeline window and a red-and-white icon will appear over the image swatch, letting you rotate the image via the mouse. Many of

these commands are further enhanced by keyboard shortcuts, which, for example, snap rotation events to multiples of 15 degrees or maintain the aspect ratio during scaling.

Version 3.0 makes it easier to animate effects parameters, too, by automatically creating function curves as you edit each parameter. For instance, to produce any of Composer's animated effects, you need only move a keyframe position in the timeline and change one or more effects parameters: This automatically creates

Composer 3.0

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CIRCLE 60

Price: Professional version (reviewed), \$9500, entry-level version, \$5000. Price may vary according to your SGI hardware.

Minimum system requirements: Any SGI workstation.

Composer 3.0 makes producing DVE-type effects—such as rolls, tumbles, and spins—a snap. The program also includes numerous

the necessary keyframes along with an associated function curve, which appears in the timeline window. You can edit each curve's keyframes directly in the timeline window or via dialog boxes (event editors), which provide sliders, submenus, and numerous fields for entering individual parameter values.

Besides being easier to use, Composer has 15 new effects (there were already 80 effects and events). Among these is chroma key, which gives you precise control over the range of color to extract from a given sequence. You also can specify an area of gradation for color removal, selectable by hue, saturation, or value; this lets you produce soft-edged chroma keys that blend into your background. Additionally, you can layer chroma keys; this lets you remove residual color or spill in multiple passes.

Another fascinating new effect is Displace, which lets you alter the position of one image's pixels with that of another image's pixels. Using this effect, you could, for example, make a video sequence of flying birds ripple, distort, or transition from a static to a moving image. Displace is useful for a vast range of watery or refractive effects, too. Plus, it's a lot of fun to experiment with it. Another new function, Move 3D, makes creating numerous DVE-type effects—including rolls, tumbles, and spins—easy.

A tool that's particularly useful for game production is the custom palette-creation tool, which lets you build palettes from 1 to 64 bits per pixel. This function provides control over sampling and diffusion methodology, and it provides an option to protect a specific color range from dithering. You also can modify an existing palette by editing individual colors via the new color selector, which is adjustable via RGB or HSV color models.

Some of the new batch commands include FPP, which calls a script file that specifies a frame procedure to be executed before compositing; FPO, which specifies a frame procedure to be executed after compositing but before output to video; and Lines, which makes it possible to distribute single images across a series of computers scanline by scanline.

PAINTER 3.0 EXTENDS THE SPECTRUM OF COMPUTER PAINTING

The programmers at Fractal Design have an impressive and consistent track record when it comes to innovation. And they continue to hit the mark with Painter 3.0. (There are Mac, Power Mac, and Windows versions; I reviewed the Mac software.)

As a video graphics professional, I have been a dedicated user of Fractal's ColorStudio, a program which hasn't been upgraded in years, but whose features are being slowly incorporated into Painter. I've also followed the evolution of Painter because of its powerful, creative features.

But before I say more about Painter 3.0's new features, let me start by saying that the minimum requirements for RAM are, in my

opinion, just that—minimum. Fractal claims it was able to "optimize the application so successfully" that you need only 5MB of RAM to run Painter 3.0. (This is detailed in a Read Me file; the actual packaging says 6MB for Mac, 8MB for Power Mac.) However in my test at 5MB of RAM, as soon as I started adding multiple floating layers to my document (and I was working at only 640x480, 72dpi with 24-bit color), I began to experience intense slowdowns—actually, more like significant time-outs. Certainly anyone planning to work at print-level resolutions or who wants to do any kind of sophisticated layering would be much better served by 20MB of RAM. Furthermore, given the computing intensity of some of Painter's new features, power users will certainly be happier on a Power Mac. But enough about systems.

As soon as you launch Painter 3.0, you can't miss the fact that Fractal completely overhauled the interface. This program has a mind-boggling list of features, and Fractal addressed the challenge of presenting and organizing these features in an innovative way. Using a device created for Fractal's Dabbler (a painting program for kids), many of Painter's eight main tool

Perhaps my one criticism of 3.0 is the omission of an Undo command, which I would certainly welcome—particularly given the level of complexity supported by this program. But on the whole, Wavefront has done an excellent job

in upgrading Composer. The interactivity and overall feel of this program are excellent, and the image swatches and timeline combine to provide exceptional feedback for each event, effect, and keyframe edit. With version 3.0, Wavefront has created a video- and film-production tool that is both sophisticated and accessible. **CGW**

In upgrading Composer to 3.0, Wavefront makes what was once a functional program more approachable and intuitive, and thus, more useful.

Tim Forcade is a CGW contributing editor with more than 20 years of experience as an artist/designer/photographer. He founded Forcade & Associates (Lawrence, KS; Evanston, IL), a graphics company specializing in the design and production of 2D/3D illustration/animation/multimedia applications.

SIMPLY 3D MISSES ITS MARK

Targeting the first-time user, Simply 3D from Visual Software is designed to enhance your existing drawing and painting applications by letting you import 2D drawings and apply 3D attributes to them. Then, by adding color, textures, lighting, and motion, you can create simple animations. The problem is, Simply 3D is not simple to use.

Simply 3D comes on a CD and includes Renderze Live EZ (a scaled-down version of the company's Renderze Live rendering program); Visual Font, the company's utility for extruding and beveling TrueType fonts to create 3D objects; a clip-art library of 100 3D objects and 70 seamless bitmap textures; three separate animation players; a well-laid-out, nine-step tutorial,

REVIEWS

Painter 3.0



The Floater List palette in Painter 3.0 provides an easy way to manage and manipulate multiple floating selections.

palettes now feature a click-to-expand "drawer" for accessing additional options. For example, the brush palette keeps the five brushes you've used most recently in a nice, small window. To get another brush, click open the drawer and choose from a much larger selection.

I have always appreciated the intuitiveness of Painter and ColorStudio's palette-oriented interfaces, and now Painter 3.0 takes that to a new

level by combining features that naturally seem to go together. For example, I particularly like the art materials palette, which incorporates color, gradient, weave, and paper selectors within one palette. I can hardly imagine a better arrangement of such a large array of features.

One of the most important—and for me, disappointing—features of this upgrade is the integration of the floating and layering features of PainterX2 into 3.0. It's not so much the functionality, but the difficulty in using these features, that bothers me. For those of you not familiar

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CIRCLE 61

Price: Mac only, \$499. Upgrades are free if you bought 2.0 after 7/15/94, \$149 for other versions, \$99 if you are a registered owner of Painter X2

Minimum system requirements: Mac or Power Mac; 5MB of RAM, System 6.0.7+. Some effects require a floating-point unit

with X2, floaters are image elements that remain independent of the background, even when deselected. Because Painter treats these floating bitmaps as objects, you can layer and compose multiple floaters into collage-type images with ease. The big advantage is you don't have to commit any element to your final bitmap until you are ready. Fractal was a leader in providing this ability.

The problem with floaters, though, is that you still face a significant learning curve when trying to manage this process. There are two basic steps to creating a floating selection: First, you select an image using any selection tool (selections are a type of "path" in Painter; there are also outline, curve, and mask paths); then you turn the selection into a floater by clicking inside it with the floater selection tool. This may seem simple in text, and initial steps are straightforward, but floaters can get quite confusing once you get deeper into them. I also experienced some buggy inconsistencies in which some size and color manipulations of floaters did not function correctly or were unavailable depending on how I had grouped multiple floaters. But to its benefit, Painter's floaters

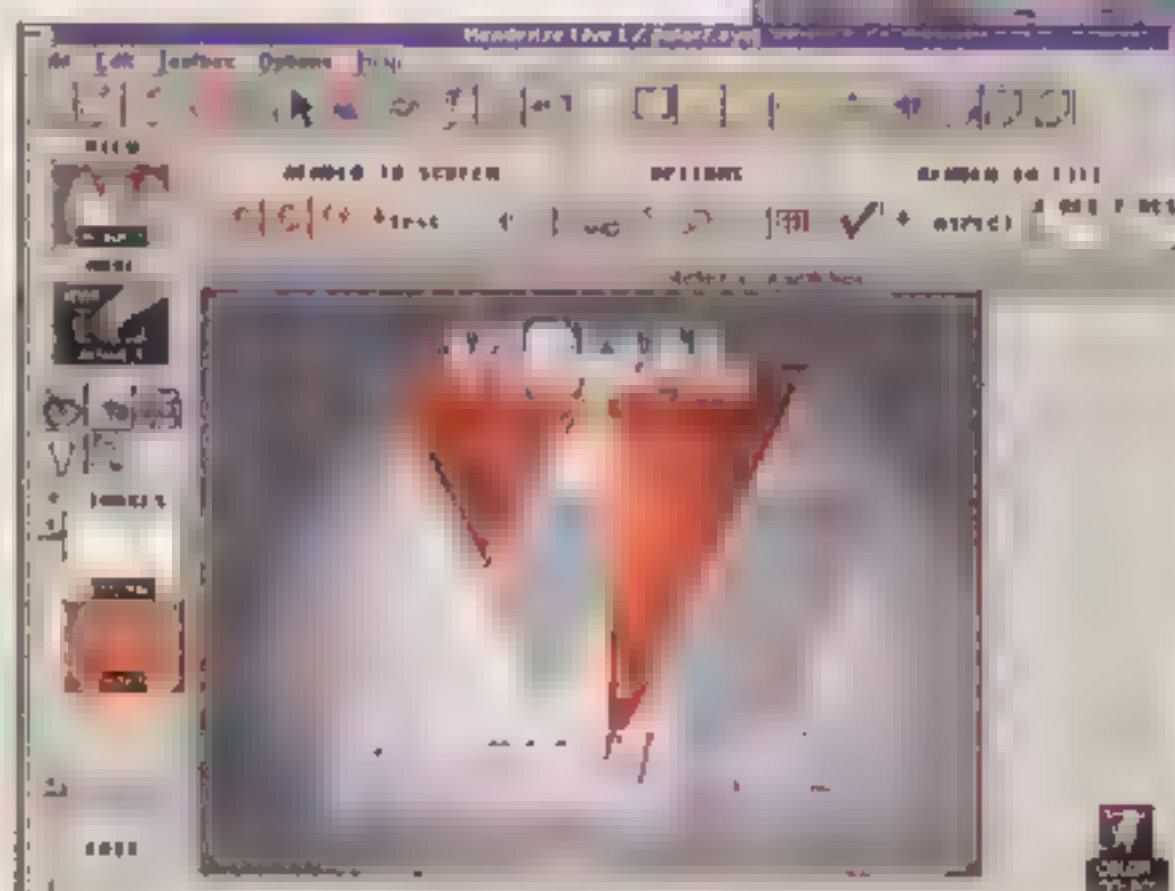
and a series of step-by-step multimedia presentations. Also included is Win32S, the 32-bit Windows extension necessary for running a true 32-bit application, and a well-written 250+ page manual.

Unfortunately, I ran into trouble immediately upon trying to install Simply 3D. Since I already had the latest animation players on my system, I didn't want to install them again. But much to my dismay, Simply 3D went ahead and installed several older system files over my existing ones without giving me the option to skip them. To make matters worse, once installation was complete, my system immediately froze. Upon rebooting, I found my FAT table was corrupted, and I found major damage to my directory tree which required some heavy-duty help from Norton Utilities. A call to technical support resulted in a lack of explanation for the occurrence. Only by disabling 32-bit file access could I finally install the program. Then I re-enabled 32-bit file access with no further problems. (Note: Visual Software has since published a fix for this bug.)

Once I finally got the program up and running, I was presented with a user interface con-

sisting of icons across the top, a single viewspace, and "wells" down the side. You can get a description of any icon by moving the mouse over it; you also can float icons. For the most part, you use the wells to edit and manipulate objects. There are five main wells: light, texture, view, move, and edit.

Creating a scene involves several steps. When you start Simply 3D, the view and light

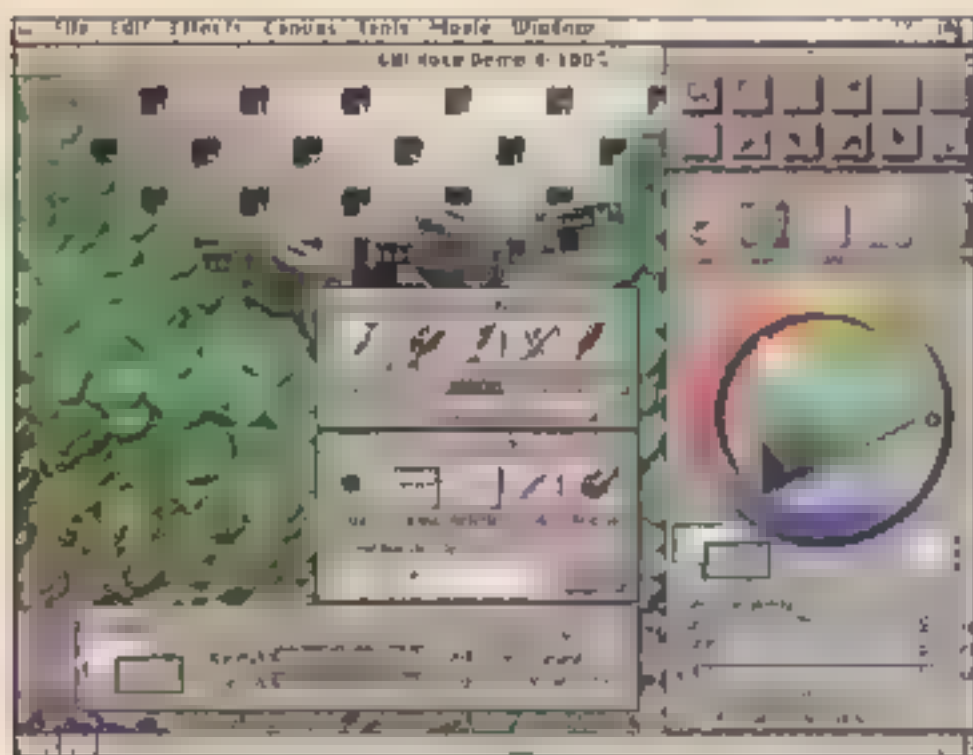


Simply 3D

Woodland Hills, CA
818-883-7900
CIRCLE 62

Price: \$60
Minimum system requirements: 33MHz 80486-based PC; 8MB of RAM; 11MB of hard-disk space; 800x600 SVGA; CD-ROM drive

Targeted at first-time users, Simply 3D from Visual Software enhances your existing drawing and painting applications by letting you import 2D drawings and apply 3D attributes to them. You also can add color, textures, lighting, and motion as well as create simple animations.



Painter 3.0's impressive array of image creation tools includes new palettes for brushes and art materials. To create this title background, the author used Painter's new image hose, which lets you "spray" a sequence of images onto your screen.

palette makes the management and grouping of these graphical objects a relative no-brainer once you have successfully defined your floating selections.

The best news about Painter 3.0 is its incredible array of new goodies. One of my favorites is the awesome automatic drop-shadow feature, which adds a fully customizable, soft-edged, transparent drop shadow to any floater. Painter 3.0 also features a remarkable brush called image hose, which lets you use images as the "water" in a hose-type brush that literally sprays

a sequence of these images onto your screen.

Then there's the frame stacks palette for working with "movies" (sequentially numbered frames), including animations and QuickTime files. This palette has VCR-type controls, which makes it intuitive and easy to use. And within this palette is another of my favorite features, an option called onion skin layers, which you can use in conjunction with the tracing-paper option to see as many as five frames of your work "layered" at a time. This is one of the most intuitive frame-by-frame animation painting environments I have ever seen.

There's so much more, including new brushes and paper textures, plus a CD-ROM with stock photos, movie clips, image-hose nozzles, more paper textures, brushes, floaters, and even tips and hints. There's a weave palette that lets you define textures according to the same variables that a real weaver would use. And you can "tilt" your

document on screen, much as you would a piece of paper on your desk, for more natural hand-eye coordination.

Once again, Fractal Design has stepped boldly to the edge of computer-graphics software innovation. Yes, the complexity of some features—particularly paths and floaters—can be baffling at first. But I imagine most computer artists will find Painter 3.0's array of features well worth the effort. For me, just the image hose and automatic drop shadows are worth the price of an upgrade. The fact is, Painter 3.0 offers capabilities you just won't find anywhere else. **CW**

Jon Leland is an award-winning video writer/producer/director whose Sausalito, California, company, Communication Bridges, provides videos, seminars, and interactive media. His most recent production, "The Digital Video-Video," is an overview of professional digital-video systems.

functions have default settings; however to do any work, you first must drop these into the View well—which I did. Next, I imported one of the provided objects, which came complete with color and material attributes. By dropping the object into the Edit well, I could apply a variety of options regarding mapping placement, object attributes, shadow casting, and color. By dropping a given element into the Move well, another set of options became available, including X,Y,Z coordinates for moving and scaling.

If this method of working seems confusing and completely unintuitive, that's because it is—and I've worked with a number of more complicated 3D programs. I think first-time users would find this especially confusing.

Another point to keep in mind: There are no drawing or modeling tools in this program. You work with either the 100 3D objects provided on the CD, or with an imported file from a different program. Although the idea is to keep operation simple—and the object library that comes with

Simply 3D is extensive—I would still like to see some drawing tools included. Perhaps the best part of Simply 3D, however, is its texture library. For \$60, you get 70 seamless, textured bitmaps—which any artist can appreciate.

Back to my project. Once I had it how I wanted it, I performed a quick render to check my results. Two points I don't like about Renderize Live EZ: You have to start a separate program to use it, and it accepts only its own GED format or the Adobe Illustrator format. However EZ does provide several nice options for rendering, including antialiasing, shadow computations, high-output texture sampling, and alpha channel. You can render a scene to nine different formats. However you are limited to a resolution of 640x480 for still images, 320x240 for animations.

Which brings me to my next point. Animation is by far the most disappointing and confusing feature of this program. The ability to animate objects individually has been omitted, leaving only

camera movement as a method of animation. So, for example, if you had a table and a ball in your "animation," you could not animate just the ball. Fortunately, the program does support multiple cameras, so with a little ingenuity you can achieve the illusion of moving type. To do this, you use a traditional keyframer technique: Move the camera to a given point, set the keyframe, and proceed to the next point. Simply 3D also offers some nice options for animation output, including AVI, FLC, and sequential TARGAs.

In an attempt to compete with the slew of 3D applications hitting the market, Visual Software may have been premature in releasing this product. While aimed toward the first-time animator, some operations are too complex. The user interface is in desperate need of an overhaul, as are the animation capabilities. To Visual Software's credit, its technical support department was incredibly helpful—good thing, because you'll need them. **CW**

Dean Oliver is a freelance animator and writer, based in Pesotum, Illinois, who specializes in computer graphics and desktop video.

Simply 3D's method of working isn't intuitive and most likely will confuse first-time users.

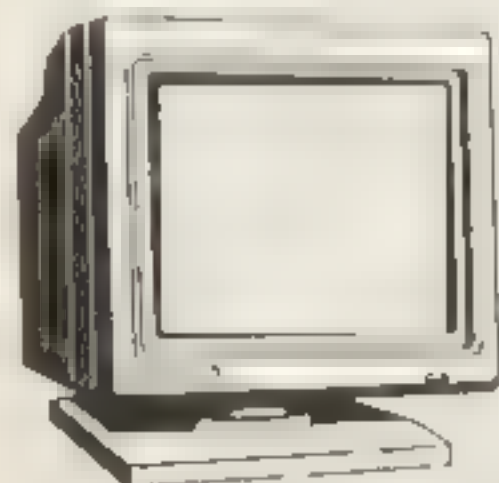
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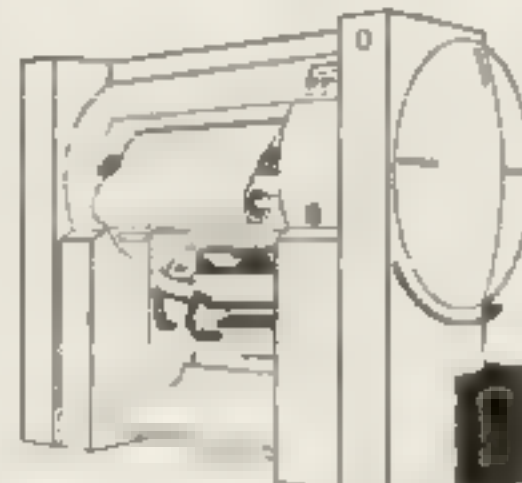
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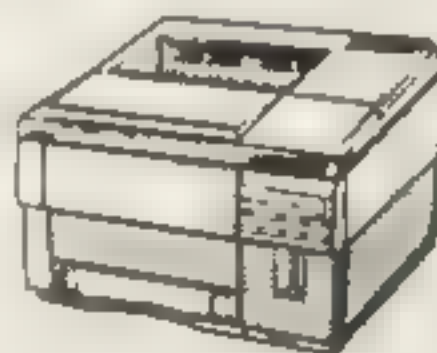
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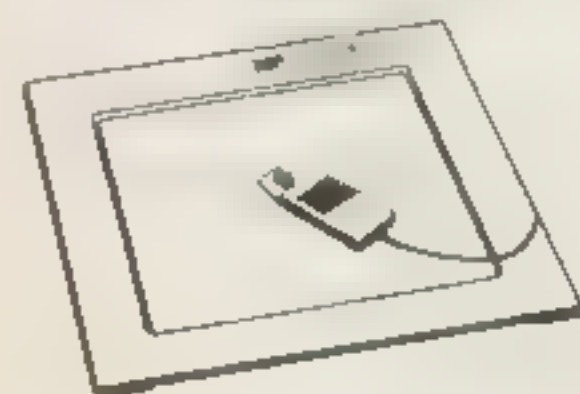
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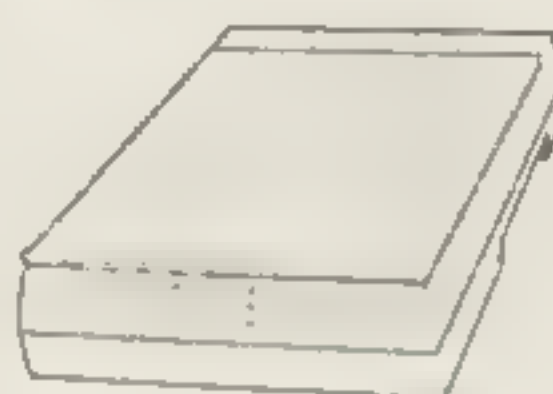
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Wacom 4x5 Pres Sen Pen 149
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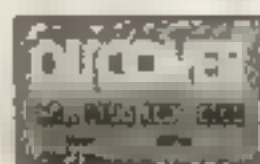
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PRODUCTS

DESIGN ENGINEERING

ADAMS Optimized

WORKSTATIONS In Version 8.0 of ADAMS, Mechanical Dynamics is enabling users to not only test but also optimize their virtual



prototypes prior to building hardware models. Two new features make this possible: design optimization capabilities and Design of Experiments (or DOE) statistical prediction techniques. The company has also improved the software's parametric simulation and solution engine. Currently, the software runs on Unix workstations from SGI, HP, Sun, IBM, and Digital, a version for Intel PCs under Windows NT is in the works. (Ann Arbor, MI; 313-994-3800)
CIRCLE 72

Design Checker

PC With Vibrant Graphics' 3D Companion, users can interactively control via mouse rendered 3D drawings inside AutoCAD, then check the images for accuracy and aesthetics throughout the design process. For presentations, walk-throughs can be saved and played back in a separate window. Vibrant is offering this product—which is compatible with AutoCAD Releases 12 and 13 for DOS—as part of a productivity bundle with SoftEngine 3 for \$395. (Austin, TX; 512-250-1711)
CIRCLE 73

Geometric Modeling

WORKSTATIONS Variable radius blending and minimum distance calculations are key additions in Version 1.6 of Spatial Technology's ACIS Geometric Modeling Kernel. Parametric curve and surface intersectors have been upgraded and extended, and the spinning, sweeping, and skinning functionality allow more flexibility in model creation and can better handle difficult degenerate cases. The N-sided patch, originally introduced in ACIS 1.5, now offers improvements in the quality or fairness of the patch, making the default shape more predictable. Also, N-sided patches now support sides of zero length. This version is shipping for Microsoft Windows 3.1 and NT, Sun SPARC (SunOS and Solaris), HP 9000/7xx (HP-UX), and Silicon Graphics (IRIX) platforms. (Boulder, CO; 303-449-0649)
CIRCLE 74

New Data Visualizer

WORKSTATIONS An advanced motion sequencer, arbitrary cutaways, enhanced image quality, and hardware texture mapping highlight Version 3.1 of Wavefront's Data Visualizer. The software—which ranges in price from \$6500 to \$9500 and runs on workstations from IBM, HP, SGI, and Sun—offers multiple forms of 3D and time-dependent (4D) field data types, including structured, unstructured, multiblock, adaptive, and hybrid. Meanwhile, image quality is improved with the ability to utilize hardware texture mapping and to generate images of up to 8000x8000 pixels. (Santa Barbara, CA; 805-962-8117)
CIRCLE 75

ARCHITECTURAL DESIGN

Home Building

PC DataCAD 6 from Cadkey offers a customizable icon toolbar, automated 3D framing utility, color photorealistic rendering with



RenderStar 2 from RenderStar Technology BV, and DataCAD Estimator—an optional cost-estimating module that builds on Cadkey's functionality for the AEC markets. The \$149.95 program can produce a complete architectural design, from 2D annotated production drawings to 3D photorealistic renderings and animated fly-throughs. (Windson, CT; 203-298-8888)
CIRCLE 76

VISUAL COMMUNICATIONS

Jammin' Effects

MAC Elastic Reality's TransJammer (TJ) offers film, video, and multimedia professionals a total of 100 antialiased, resolution-independent transitional effects, from which up to 800 variations can be created, for producing QuickTime slide shows incorporating transitions between still or moving imagery. Each effect plugs into Adobe Premiere V2.0 or later for the Mac. A Mac Power Mac version costs \$149.95, a Windows version should be available Q2. (Madison, WI; 608-273-6585)
CIRCLE 77

3D Studio Plug-Ins

PC With Autodesk's new Plug-In Toolkit, 3D Studio Release 4 users can create six types of

plug-ins: image processing, procedural modeling, animated stand-ins, solid textures, keyframe procedures, and bitmap processes. The \$249 product also provides new access to the software's rendering Z-buffer for image-processing plug-ins and new materials-creation functions for procedural modeling plug-ins. Also, the Direct-Call Library has been expanded to facilitate the creation of native interfaces within 3D Studio that reflect the look and feel of a given application developer. (Sausalito, CA; 415-332-2344)
CIRCLE 78

Super Graphics

PC New from Primary Image is the P10, a PC-hosted image generator offering graphics supercomputer performance for applications such as simulation and training, virtual reality, and leisure and entertainment. Using a board interconnection bus operating at up to 500MB per second, the P10 offers peak draw rates ranging from 200,000 to 1.6 million triangles per second, from 50,000 to 400,000 textured polygons per second, and from 20 million to 160 million textured pixels per second. (Orlando, FL; 407-658-0557)
CIRCLE 79

DISPLAY

Pacom Monitors

PC/MAC The three new monitors from Pacom meet MBPFI standards for low emissions, are Energy-Star-compliant, and offer on-screen controls that enable users to adjust pincushioning, trapezoidal distortion, color



attributes, and more. The 15-inch KC51r (\$449) offers 76Hz and 60Hz refresh rates with resolutions of 800x600 and 1024x768, respectively. The 15-inch KC51e (\$449) boasts a 1024x768 resolution and a refresh rate of up to 75Hz. The 17-inch KC71r (\$799) features a 1280x1024 resolution and a 60Hz refresh rate. (Santa Clara, CA; 408-982-9375)
CIRCLE 80

High-Res LCDs

PC/MAC/WORKSTATIONS The Graphix Z, the

PRODUCTS

latest model in nView's Z series of LCD projection panels projects text and graphics in 1.4 million colors using a 1024x768 active matrix display and is compatible with sources (including VGA, SVGA, Mac II, and Sun workstations) offering 1152x900 resolution which can be cropped to fit the LCD screen. (Newport News, VA; 800-736-8439)

CIRCLE 81

INPUT

Capturing Motion

WORKSTATION According to Polhemus, its UltraTrak is the only motion-capture system to provide real-time data from a virtually unlimited number of sensors. Combined with the Long Ranger transmitter, UltraTrak provides movie studios and production houses involved in animation and special effects a working area of more than 908 square feet. The system comes in a single chassis with an integral 486 computer to act as a server. Data is transmitted to an SGI workstation over an Ethernet interface. (Colchester, VT; 802-655-3139)

CIRCLE 82

Reliable Scanning

PC/MAC Belisys' new 30-bit, 400x1600dpi flatbed scanner—the Reli4830 PC/TE—recognizes more than 1 billion colors and uses ColdScan technology, which provides cold lamp scanning, a process that uses cold cathode lamps to capture color images. The \$1999 scanner includes a transparency adapter and ships with a full version of Photoshop, OmniPage Direct, ArtScan Professional, a transparency adapter, and a full version of Kai's PowerTools. (Milpitas, CA; 408-945-3113)

CIRCLE 83

GRAPHIC ARTS

Desktop Video Paint

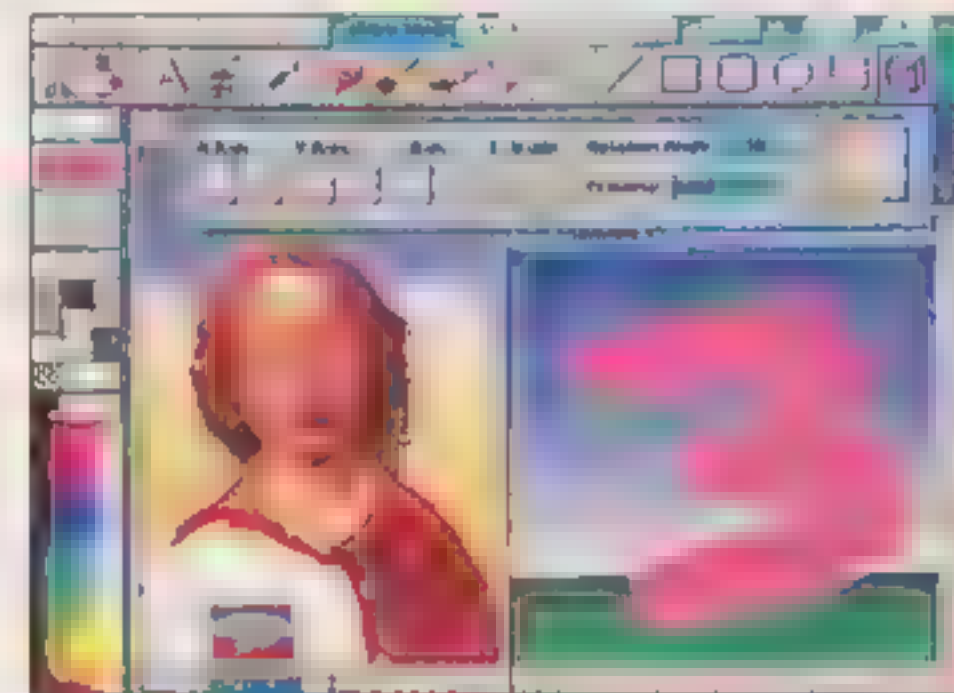
MAC According to Strata Inc., its MediaPaint desktop video application is the first to enable users to paint directly onto QuickTime movies—frame by frame or while the movie is playing. By painting onto a layer (using live Alpha technology) over the video, users can paint on the animation without changing the underlying movie. Using a QuickTime movie as a brush, users can paint one movie directly

onto another. The \$395 MediaPaint replaces the Video Graffiti product previously offered by Neil Media, which has been acquired by Strata. Upgrades from Video Graffiti to MediaPaint cost \$59. (St. George, UT; 801-628-5218)

CIRCLE 84

New NeoPaint

PC Version 3 of NeoSoft's NeoPaint adds 24-bit color support to its paint and image-editing tools and can be run under DOS and under Windows or OS/2. New features include an oil



paint tool, a quill pen, fixed palette optimization, and a freeform 3D extrusion tool. The \$69.95 program also offers enhanced rotation, special-effect filters, printing performance, graphics board support, palette optimization, gradients, color replacement, text import, and file handling. (Bend, OR; 503-389-5489)

CIRCLE 85

SYSTEMS

Powerful Presenter

PC Thanks to a patented hinge Revere Technology has incorporated into the TFI active-matrix screen of its Power Cruiser multimedia notebook PC, users can convert the PC into an LCD projection panel for use with overhead projectors. Added key features include an Intel 486 3.3V CPU with up to 24MB of on-board memory (64MB will be available later), an optional internal SCSI board, an internal audio board, an external multimedia adapter, and a portable docking station. Prices range from \$6995 to \$7795; the Multimedia Adapter costs \$870, and the Portable Docking Station costs \$400. (Camarillo, CA; 800-220-8919)

CIRCLE 86

Portable Workstation

WORKSTATION Powered by the 85MHz microSPARC II microprocessor, the PowerLite 85 from RDI Computer Corp. integrates up to 2.4GB of internal hard-disk storage capacity (4.4GB with external options), TGA graphics acceleration, and a 1024x768 flat-panel color display into an 8.5-pound, notebook-size computer. Using enabling hardware and operating system technology from Sun STB and SunSoft, respectively, the PowerLite 85 is 100% compatible with Solaris and

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PRODUCTS

SunOS applications. Pricing starts at \$11,995 for the system. The portable workstation comes bundled with RDI's Virtual Workgroup Architecture, a Motif-based framework of software tools for automatic network connection, network administration, and internal fax/modem operation. (Carlsbad, CA; 800-RDI-FIE)

CIRCLE 87

Video/Film Editing

MAC New features (which vary by model) for version 5.2 of Avid Technology's Media Composer and Film Composer digital nonlinear video- and film-editing systems include Avid Video Resolution 27, Avid's two-field image resolution which provides sharp pictures on complex images; enhanced real-time 2D digital video effects; real-time chroma and luma keys; software-based multicamera editing; support for third-party Photoshop-compatible plug-ins; and support for Avid's Media Reader option. (Beverly Hills, CA; 800-640-6789)

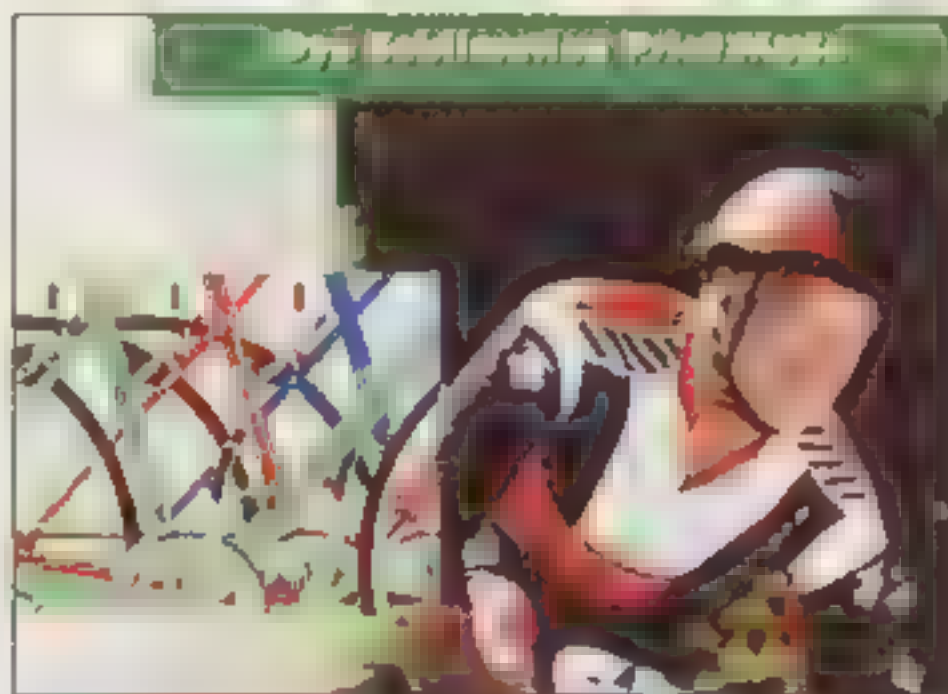
CIRCLE 88

OUTPUT

Brilliant Printing

PC Three printing modes—thermal transfer, Graphic Color (variable-dot thermal transfer or VT2), and Photo Color (dye sublimation)—

give users of NEC's SuperScript Color 3000 printer various levels of print quality while providing an intuitive proofing method and custom color-matching capabilities. The printer (priced at less than \$1000) is a licensed



Microsoft "Windows Printing System," which relies on the host computer (a minimum configuration of 4MB of RAM and a 486 processor running at 25MHz) to process the printed data. Consequently, users can enhance the printer's performance by upgrading the CPU or system RAM. (Beverly Hills, CA; 800-264-8000)

CIRCLE 89

Dye-Sub Duo

PC/MAC Sony's new A4-size, PostScript- and SCSI-compatible U-P-D8800 dye-sublimation color printer features user-selectable output resolution (150- or 300dpi) and speeds of either

63 or less than 90 seconds per print. The A7 U-P-5500 dye-sub color printer, meanwhile, provides analog or digital capability, produces a rated print speed of 30 seconds (38 seconds digital), and offers a resolution of 300dpi. Prices start at \$7495. (Park Ridge, NJ; 800-472-SONY)

CIRCLE 90

Portable Printer

PC According to Digital Equipment Corp., its 2.4-pound, 11.6x5.2x2.5-inch DEWriter 90ip inkjet printer increases productivity by enabling users to quickly generate quality output, in the office or on the road. Featuring a print speed of two pages per minute, 300x300dpi resolution, and an integral auto sheet feeder that holds up to 15 sheets of paper, the \$340 printer ships with a Windows 3.1 driver, HP PCL-3 emulation, and a parallel interface for PC compatibility and is EPA Energy Star-compliant. (Maynard, MA; 800-777-4349)

CIRCLE 91

CD-ROM LIBRARIES

Classic Textures


MAC Pixar's Classic Textures Vol. 2 (\$169) features 100 textures in 10 categories, including clouds, exotic marbles, milled metals, flowers, and water. A patented technology enables the 512x512, 24-bit TIF images (which can be ac-

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PRODUCTS

RESOURCES

Digital Photos

Targeted at graphic designers, illustrators, photographers, art directors, printers and artists, *Digital Photo Illustration* is a reference guide featuring the creative-design approaches possible in color electronic illustration. Van Nostrand Reinhold (New York), 156 pages, \$36.95

CIRCLE 95

Game Programming

PC Game Programming Explorer is a book/disk set that provides the tools programmers need to create PC games. Some subjects covered include bitmaps, fast-action animation, scrolling, collision detection, video memory management, joystick and mouse programming, speed calibration, sound effects, and music. The Coriolis Group (Scottsdale, AZ), 512 pages, \$34.95

CIRCLE 96

Advanced Topics in Science

Written by a panel of experts in the visualization field, *Scientific Visualization Advances and Challenges* covers volume graphics, modeling and visualization of large data sets, the perception and interface of technology, and other advances in this field. AP Professional (San Diego), 532 pages, \$35

CIRCLE 97

PC-Based Ray Tracing

Ray-Tracing Creations, Second Edition is a book/disk set designed to teach beginners and intermediate graphics users all about ray tracing: how to create photorealistic and surrealistic images, and how to animate such images. Waste Group Press (Corte Madera, CA), 571 pages, \$39.95

CIRCLE 98

VR Guide

Virtual Reality: Through the New Looking Glass provides an overview of virtual-reality technology and how it is becoming more popular in today's society. A listing of virtual-reality companies and a product resource list are also included. Windcrest/McGraw-Hill (Blue Ridge Summit, PA), 416 pages, \$24.95

CIRCLE 99

PC Graphics Effects

Outrageous PC FX is a book/CD set that explains how to create on a PC such effects as morphing, fractal textures, sphezened images, and 3D rendering. MIS Press (New York), 450 pages, \$45.95

CIRCLE 100

Technology Forecast

Visions of the Future: Art, Technology and Computing in the Twenty-First Century provides the answers to questions on how computers and computer art will be affected during the turn of the century. St. Martin's Press (New York), 212 pages, \$16.95

CIRCLE 101

cessed via any player that reads an ISO 9660 CD format) to be tiled seamlessly. (Richmond, CA, 510-236-4000)

CIRCLE 92

Pro Photos

PC/MAC From Corel Corp. comes the Corel Stock Photo Library. Consisting of 200 Corel Professional Photo CD-ROM titles (for a total of 20,000 images), this \$995 product for Mac and Windows users offers a Visual Database for quick searches, a Corel Professional Photos Quick Tour, which gives an overview of all applications and utilities, and a working model of CorelDRAW 5, albeit without printing and saving capabilities. Updated utilities in the product include Corel Photo CD Lab Version 2.1 and the Windows version of the Corel ArtView Screen Saver. (Ontario, Canada; 613-728-8200)

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BOARD-LEVEL

Graphics Controller

PC/WORKSTATIONS Univision Technologies Aurora PCI is a PCI-bus-based, 64-bit graphics accelerator for Windows, multimedia, and CAD applications that provides 24-bit true-color images at up to 1600x1200 resolution with eight independent overlay planes. The 64-bit internal data path between the dual-ported VRAMs and the display generator hardware provides a graphics superhighway directly to the user's monitor. VRAM is available in either 4MB or 8MB sizes, depending on the viewable resolution required. (Burlington, MA; 617-221-6700)

CIRCLE 94



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EVENTS

February

7-9 Intermedia, held in San Francisco. Contact: Reed Exhibition Companies (203-840-5322); (fax: 203-840-9670)

8-11 CONCEPTS '95, held in Lake Buena Vista, FL. Contact: Graphic Arts Show Company (703-264-7200); (fax: 703-620-9187)

15-16 Interactive Multimedia Conference, held in New York City. Contact: Piper Jaffray (206-287-8831); (fax: 206-287-8980)

20-23 Fifth Annual Digital Hollywood, held in Beverly Hills, CA. Contact: American Expositions Inc. (212-226-4141); (fax: 212-226-4983)

25-27 Post/LA, held in Santa Monica, CA. Contact: Dennis Davidson Assoc. Inc. (213-954-5858); (fax: 213-954-5850)

27-MAR. 2 EDMS Focus '95, held in Orlando, FL. Contact: The Kalthoff Group (513-794-3367); (fax: 513-794-3363)

March

7-8 Daratech CAD/CAM/CAE Strategy Workshops, held in Cambridge, MA. Contact: Daratech (617-354-2339); (fax: 617-354-7822)

13-16 National Design Engineering Show and Conference, held in Chicago. Contact: Reed Exhibition Companies (203-840-5878); (fax: 203-840-9878)

14-16 New Media Expo, held in Los Angeles. Contact: The Interface Group (617-449-6600); (fax: 617-449-2674)

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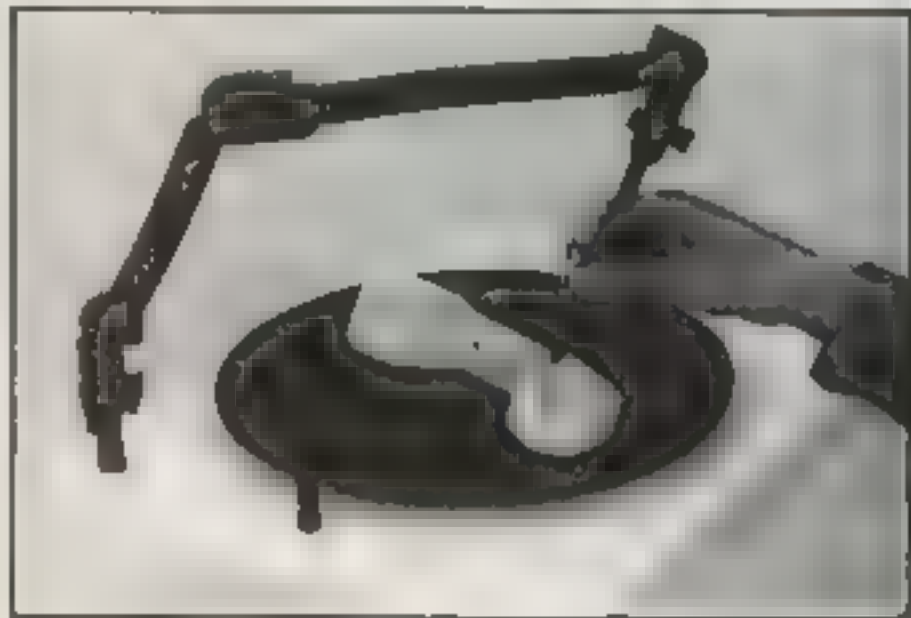
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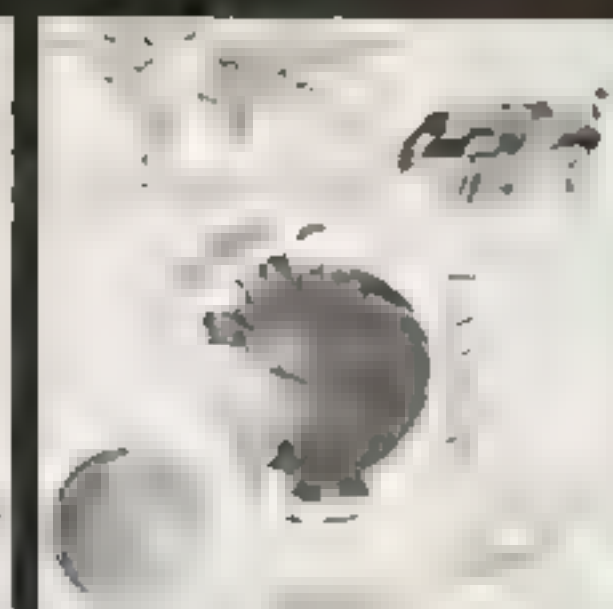
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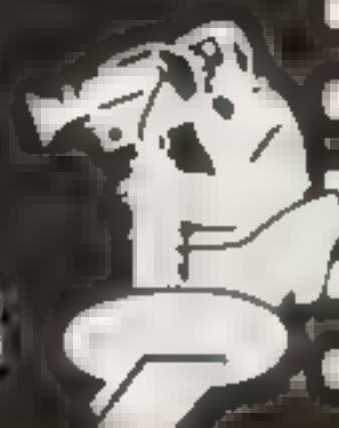
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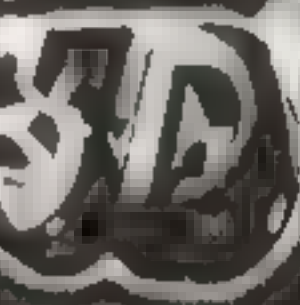
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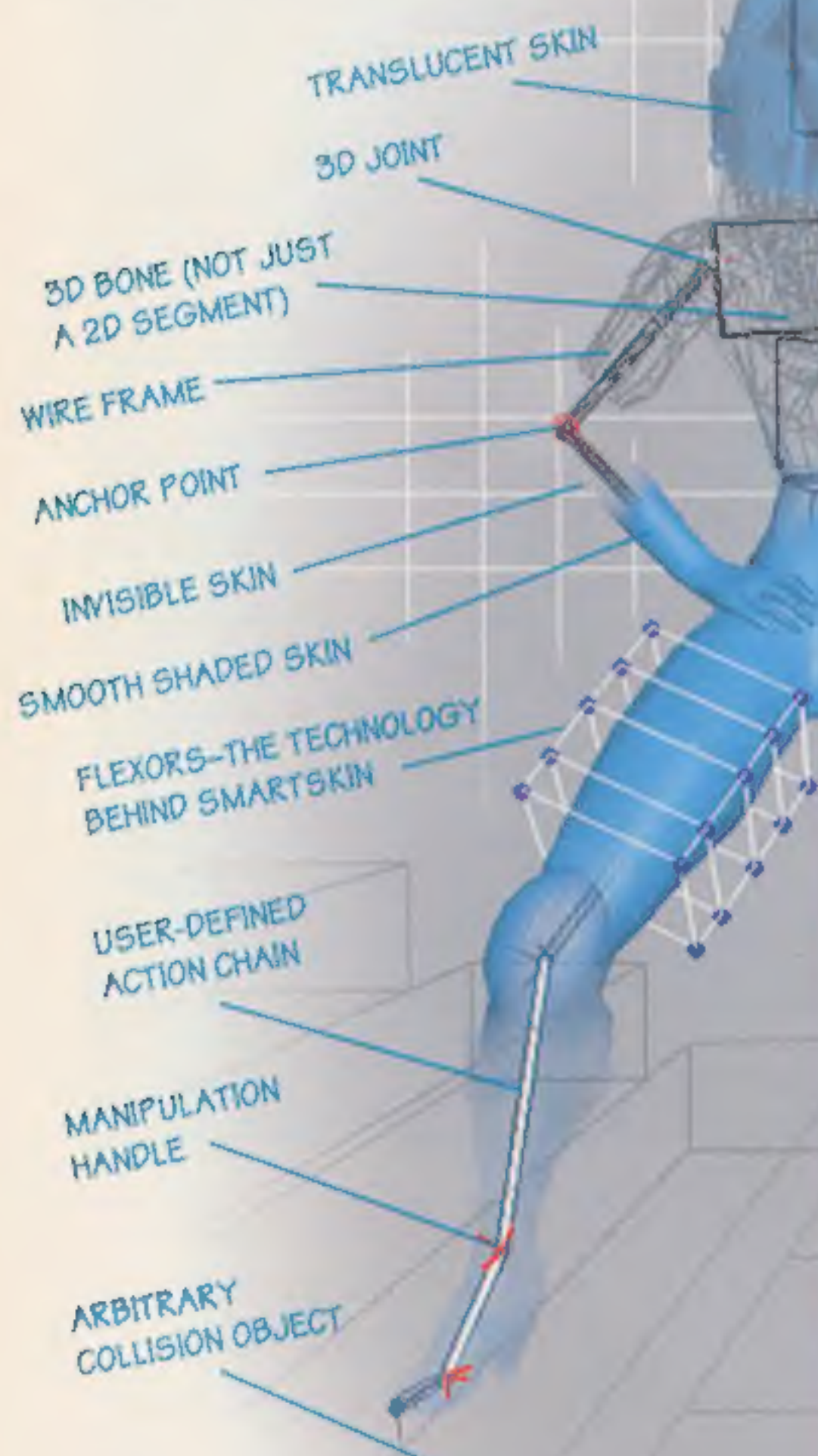
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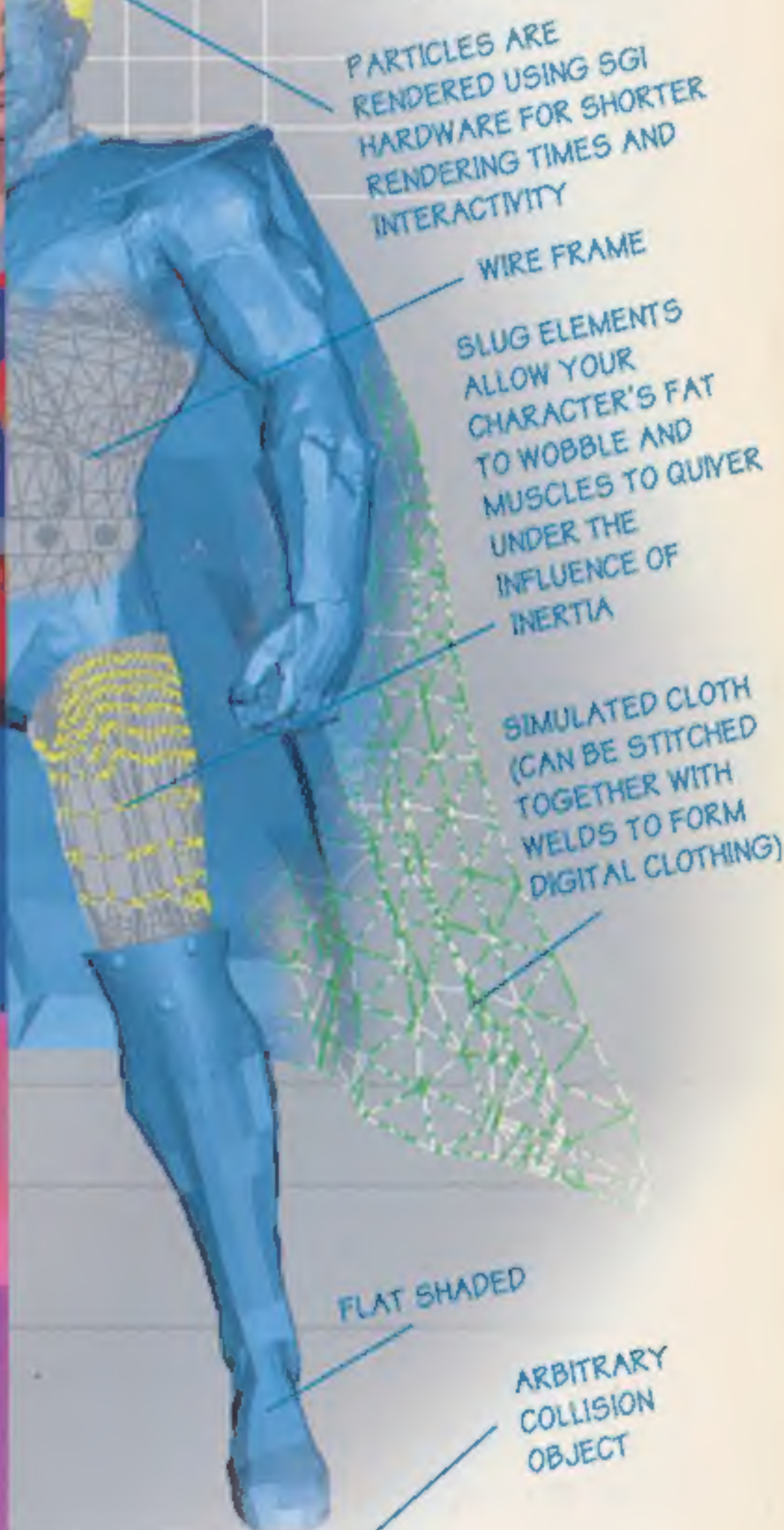


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